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THE GEOGRAPHY OF POST-WAR AIR ROUTES

Evening Meeting of the Society, 6 December 1943

THE PRESIDENT (The Rt. Hon. Sir GEORGE CLERK) said: This evening we are to have a discussion on the geography of post-war air routes. I need hardly say how vital a bearing this question has on the life we are going to face when this war is over. Lord Brabazon of Tara has kindly undertaken to open the discussion. The name of Moore-Brabazon is famous in the history of British aviation. He holds Pilot's Certificate No. 1 of the Royal Aero Club; was a member of the first Civil Aviation Committee; he has been President of the Royal Aeronautical Society, and recently he was Minister of Aircraft Production. No one could be better qualified to inform us on some of the fundamental questions governing the choice of air routes, the relative demerits of snowy mountains and waterless deserts on the route, the relative advantage of the most direct great circle route as against a longer one with intermediate stations, and traffic and supplies.

The Society has made some maps which may—I can safely say will—be useful to illustrate these questions of shortest routes and traffic across the poles, which are a very large part of geography, and a thing which comes very closely home to us. After Lord Brabazon has spoken I shall ask our Secretary, who is one of the greatest authorities on this extremely intricate and difficult question, to show us a few examples.

Until lately we had as our neighbour Sir Henry Tizard, as Rector of the Imperial College. He is now the President of Magdalen, but he has been able to come here to-night, and he will speak with authority as an additional member of the Air Council and chairman of the Aeronautical Research Committee. We should value his advice on what more we can do to make maps for the study of projects in civil aviation.

LORD BRABAZON OF TARA: Mr. President, I am not here to-night to read a paper. I am here to open a discussion, and, as you will appreciate, a discussion is, so to speak, a series of "turns," rather like a music hall. I hope therefore you will not judge this evening's proceedings by my good self.

I think the subject is a little difficult, and if I roam from the true path of

geography and aviation you will forgive me. First of all, I want to say that if air transport does anything it tries to discount geographical barriers. That is one of the reasons for its popularity. For instance, in such journeys as London to Edinburgh, where you get into a sleeper and wake up in the Scottish capital, or in such journeys as Paris to Berlin, where you do the same, there is no very great attraction to go by air unless you are in a tremendous hurry. But when you get geographical considerations coming in, like the sea, then, of course, the air certainly affords great advantages. The route London–Dublin is intolerable in the ordinary way. Travelling by night, it is necessary to get out of bed at three o'clock in the morning and get into a rough boat, and the journey London–Paris is intolerable compared with the air route.

Those are advantages which the air has in ignoring geography. But let me not be manoeuvred for a moment into pretending that air transportation as such is a very delightful form of transportation. It is an exceptional one in our modern lives. It will probably grow more familiar, but at present I consider it noisy, bumpy, and dangerous. It can be very upsetting to your system, and it is intolerably dull.

What are the barriers we can break down by our aeroplanes? First of all, the great oceans. But I do not look upon these as suggesting the very great advantage of air travel, for, after all, one can cross the ocean on a tolerably comfortable boat and make a continuous journey. But there are throughout the world many geographical barriers which almost compel you to go by air. There are, of course, the great rivers of the world, which do not always have their bridges at convenient spots. There are the great jungles and the great forests which are not noticed at all when one is up in the air.

I was interested the other day, in my committee on Post-War Aviation, in having a talk with Mr. Yerex, who runs several air lines in the northern part of South America. One of those routes goes over the great forests of the Amazon. We asked him what sort of machines he wanted, and he was keen on the four-engine machine from the point of view of reliability. I ventured to interpose the remark, "Well, you can always come down on land," in reply to which he pointed out that if one came down in the forest one might be eaten by wild beasts or at any rate be cut off from all communication. I was struck by the combination of savage life in the jungle and modernity overhead.

Some mountains which get in our way are unavoidable and others are avoidable. The Rocky belt in America has given rise to many accidents, especially when the route is along narrow valleys, which is favoured when clouds come down. In Africa our route to the south with the Atlas mountains gives us an avoidable route also. But the Alps, though concentrated, are not seriously in our way, unless flying to the north from Italy. The highest mountain in Europe, Mount Elbruz, which is in the Caucasus, does not get in the way on any material routes. The Himalaya at the moment do not present any great obstacle, because nobody wants to fly straight over them, or over the great Tibetan plains. But, broadly speaking, if your machine is capable of going to 20,000 feet it can tackle most of those obstructions with fair ease, and any long-range commercial machine to-day would certainly be able to go to 20,000 feet. There are, of course, local geographical dangers; to try to ground on an aerodrome with low clouds and with hills about has, I am

afraid, accounted for very many lives. But from the point of view of commercial flying, the cathode tube, with its detection of what is in front, should certainly look after that type of danger.

Now, although Sir Henry Tizard is here I am going to say a word about scientific work, and as he will be able to reply to me afterwards I can quite understand that he may take the opportunity to do so. Tell it not in Gath, publish it not in the streets of Ascalon, but I consider that the physicists of the world have now got into such a tangle over the electron that it has become more mystical than the Trinity. The astronomer with his theory of the expanding universe is very happy in the future, but when he comes to talk backwards in time he ends us up in one lump. The ordinary physician tries his best, but you have only to mention the word Virus to him and he collapses in the face of something beyond his power to solve. Thus I come to the backward state of the science which is most mixed up with flight, namely, meteorology. The astronomer can tell us the date and hour of an eclipse fifty years hence, but the meteorologist cannot tell me whether I ought to carry an umbrella to-morrow or not. The weather is, of course, very much wrapped up with flight, and I very much want to ask these gentlemen whether the conditions of the weather are governed by geographical considerations.

The most important route in the world for flying will obviously be across the Atlantic, and there we find, anyhow from our present experience, probably worse weather than anywhere else in the world without exception. What with trade winds and the Gulf Stream, we are faced with conditions that we do not know much about, and there is a tremendous lot to be discovered. When I was starting flying very many years ago our test for the weather you could fly in was to smoke a cigarette, and if the smoke of the cigarette went away faster than you could walk then you just went home. Now, of course, any form of gale does not worry us at all. We can stand even the monsoon. The thunderstorm is unpleasant from the point of view of anybody who is a bad sailor, but apart from that, it does not worry the aeroplane very much. There is however one thing which does, and that is icing. At present icing is indeed the terror of the air. We have here to-night Sir Alan Cobham, and he is doing a lot of work in trying to solve this particular danger. Icing is a most extraordinary phenomenon. You may be flying along under perfectly satisfactory conditions, with no troubles at all, and suddenly, for no reason that you can detect, you will get icing conditions. These can develop to catastrophic conditions very quickly. The ice builds up, deforms the aeroplane, gets on the propeller and makes it unbalanced. That is far and away the most dangerous thing in flying to-day, and it is very prevalent on the Atlantic route. You can get out of it if you can get over about 22,000 feet, and a temperature of below −18°. With those two conditions you are fairly safe, but, on the other hand, you have to get to that altitude. You cannot climb to 22,000 feet in a few moments. It is a big climb, and you have to go through icing conditions.

In the Atlantic the wind, as you know, is usually from the west. During the last year we had one week of adverse winds in the Atlantic of 78 knots. That is a very strong drawback to a regular service. The wind increases in velocity at the rate of 1·2 miles per hour for every 1000 feet, and an aeroplane gains in speed 1·8 miles per hour for every 1000 feet, so you have the advantage of

about half a mile gain per hour flying against the wind, and, if coming from America, a gain of 3 miles an hour by going high.

Now I come to this very difficult map situation, which I am glad the Secretary will explain to you to-night. But I want you to appreciate one or two facts sometimes forgotten. We are really two-dimensional beings. It is quite true that we are conscious of a third dimension, but we do live on the surface of a globe in which there are no great variations in height. If you place on a sphere representing the world something on the scale of the Himalaya you would hardly notice that the surface was ruffled or that there was a bump in the earth there at all. I was working it out for my own benefit, and I found that if a curve is plotted showing height related to distance for a flight of 2000 miles, and the curve on which this is represented is 10 inches long, a height of 5 miles on that curve would correspond only to $\frac{1}{40}$ inch.

It is a very flat world we live on, it is a two-dimensional world bent in a third dimension, in the same way as we are told that space is a three-dimensional world bent in a fourth. Take a globe and put a pin in firmly at London, then attach a piece of cotton to it, and follow out the shortest routes from point to point. Mr. Hinks will tell us more about that later, but some of the lines are very interesting. On the ordinary map the route New York–London does not go directly over Newfoundland, but that is the direct route. On the route London–Tokyo you would hardly think of going to Hull and then straight on. On the route London–Melbourne you would fly north of Berlin.

But I want to warn you against thinking that we are at present able to fly these enormous distances. You may take it that in the present art or science of flying, a stage of 2000 miles is about the economic limit. It is quite true, of course, that we could fly London–New York. There is nothing to stop us. But from the point of view of useful load we should probably arrive with a couple of postcards and very little else. In order to carry any load at all we must have shorter hops. Unless the taxpayer is going to pay for aviation all over the world, it must be related to expenses, and it looks as though 1200 miles would be a good economic distance. Of course, in the Atlantic service one has to think about where you are going to stop, and there Newfoundland comes in as a stopping point, about 1900 miles from England. With strong head winds it looks as if the route through the winter would be Azores–Bermuda–New York, and, coming back, New York–Gander–England, because you would have the strong winds behind you. The New York–London proposition calls for a very big machine. I do not think you could approach that with less than 150,000 lb. weight. Our biggest bomber to-day is 70,000. There are plans for machines up to 250,000 and 300,000 lb. There again the art is being jumped up very quickly, but there are very grave troubles with things like under-carriages and even engine power, which require certain development and experience.

I want to show to the geographers here to-night that while it is very pleasant to think that they are going to be in time with their routes for the immense distances where the curvature of the earth comes in, at present from the aeronautical side we are not quite ready. It is interesting to notice that we in this country are more or less in the centre of the hemisphere of the world

Part of the Normal Mercator Projecti
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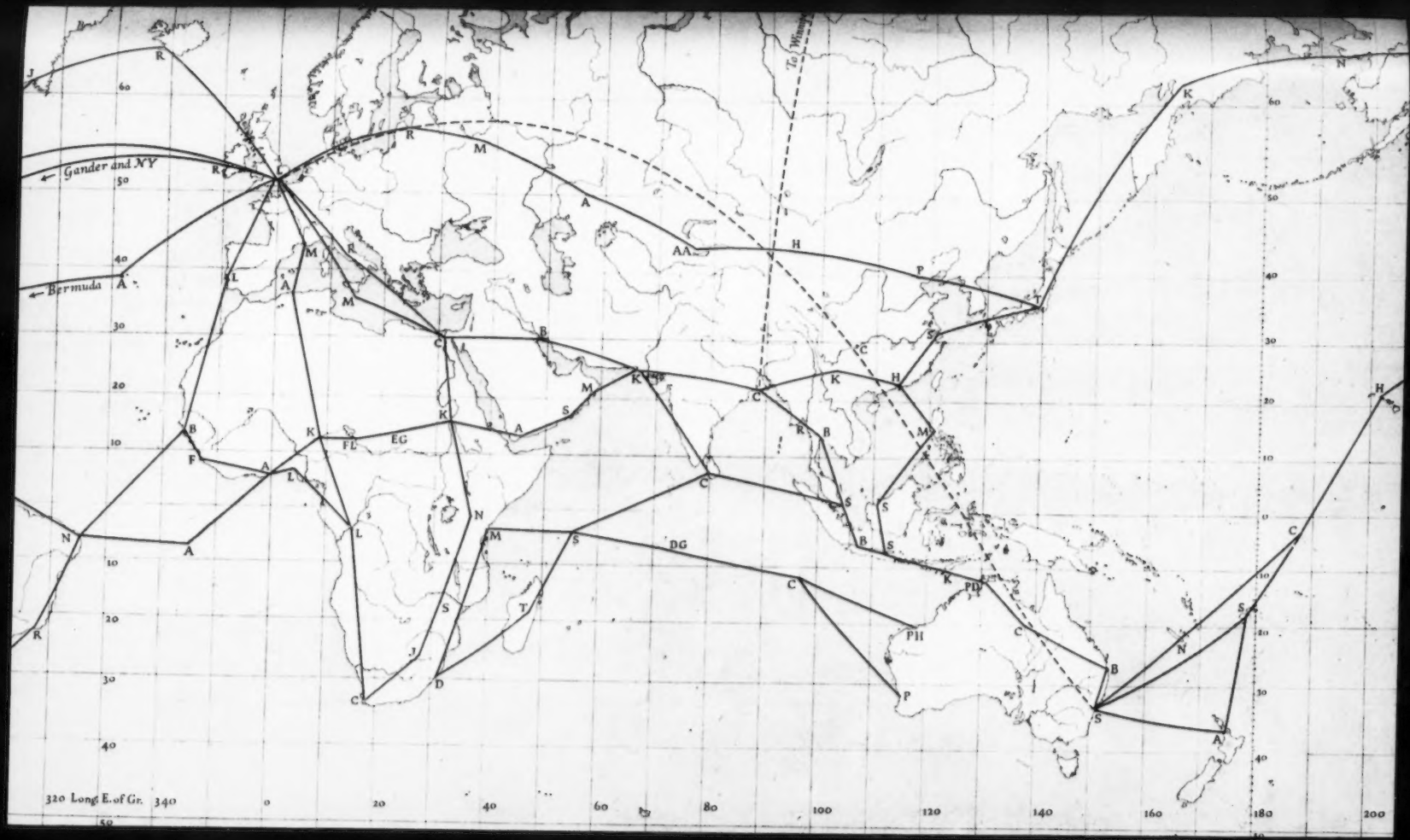
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where there is most land. The route over the Pole seems to be attractive provided you can get reliability. Temperatures at the Pole are not so low as to be dangerous, although of course, if you did come down, it might be a little lonely. The route from Moscow to California would go practically over the Pole. The distance is tremendously shortened. Flying over the Pole looks as if it would become a very common occurrence.

Well, there is the picture of aviation as it is at present. There is a tremendous lot of development to be done. But I consider one of the most dangerous things in aviation to-day is icing, and I believe that icing is wrapped up with geographical and meteorological considerations. I sincerely hope we can get over it, because it is only when we can show the world that we have a form of locomotion 100 per cent. reliable that we shall have turned the aeroplane from a destructive weapon to one of good for mankind.

The PRESIDENT: Before I ask any other of our guests to speak, it would help us if I asked the Secretary to describe some of the maps that we have made to illustrate this question of the shortest routes. This will amplify and clarify what Lord Brabazon has just said.

Mr. A. R. HINKS: The normal Mercator map answers perfectly well for air routes that do not go too far north or south. I put on the screen a normal Mercator map, and, to take the point Lord Brabazon has just made, you can see the winter route to New York and back. Almost all the more "natural" courses of the world can be studied perfectly well with that map, provided you have an auxiliary to it in the shape of what we call the transverse Mercator graticule, a device by which you can on any Mercator map lay out the great circle course, for example, between London and Sydney. This course starts off well to north of Moscow, and then goes down through Chungking to Australia. It is well to remember that Chungking is on the direct course between London and Sydney, and is almost half-way there, although, owing to the fact that the scale value of the Mercator map varies so much as you get away from the Equator, you have distances in high latitudes exaggerated and difficult to assess until the device of the transverse Mercator is used.

If we tried on that same map to draw the great circle from Calcutta to Winnipeg we should find it disappearing in the far north of Asia and coming down again in North America. That illustrates the defect of the Mercator map, that you cannot effectively get much more than 70° from the Equator.

The transverse graticule is a device by which great circles can be laid out on any Mercator map and distances measured; by a simple subtraction sum it is possible to arrive at the distance from any one point to any other. Let us take an oblique Mercator map which was designed having in mind the fact that the great circle runs very neatly around the whole of the North Pacific. You would not guess from the old Mercator map, but you can see from this, that the shortest route from Panama to Manila passes by the Aleutian Islands. No one would have guessed that, not even with the help of the globe, because you cannot see both sides of the globe at once.

I am not going into any great detail in these matters, but I put some projections on the screen to show how that great circle between Calcutta and Winnipeg, which went off the map altogether when we were using the normal Mercator, is shown here very nicely, going within about 4° of the Pole, although it is more probable that one would prefer to go via Eastern Asia and across by Fairbanks and Edmonton to Winnipeg than right across Northern Asia. The

rt of Oblique Mercator No. 1, showing Great Circle Routes

great circle distance is about 12,100 kilometres: the coastal route by Kamchatka about 15,000.

We have heard a great deal about this question of flying over the Pole, and I thought it would be interesting to put on another of our oblique Mercator maps to show the air routes from London that are likely to go farthest north. Take the western ones first. If you want to go direct from London to Vancouver you go across Southern Greenland; if you want to go to Winnipeg you go almost across the southern point of Greenland; if you want to go to San Francisco,

Zenithal equidistant projection: sketch of whole world centered on Valparaiso

although San Francisco is 14° south of Winnipeg, nevertheless, you have to go farther north than Winnipeg if you are to take the quickest route. Eastward, it is not likely that in the immediate future we shall want to take enormously long journeys to Kamchatka, and probably it would be worth while, when going to Tokyo, to call at Peiping. If we continued on either of the great circles, through Peiping or Tokyo, we should arrive at New Zealand. We must always remember that the nearer way to our Far-Eastern territories in the south is across Peiping in China.

A great deal is heard about polar routes connecting American stations and Soviet Russian stations, and I have taken another of these maps to show the great circles between New York and Leningrad or Moscow and Vladivostok.

From New York to Leningrad and Moscow you need not go nearer than 70° to the Pole, and from San Francisco to Vladivostok you need not go near the Pole at all. A simple diagram such as this enables one to see exactly what are the realities in this question of flying from points in the United States to points in Soviet Russia. I would not say that it is the last thing to be said on the subject. These maps are intended rather for exploration, but with a map like this you can get distances up to 10,000 or 15,000 kilometres with an accuracy of about 100 kilometres, which, at any rate for the first judgment, is sufficient, because you are not going to be worried about 100 kilometres when you have those winds with you or against you of which Lord Brabazon has spoken.

Those are briefly some of the uses to which we can put the set of oblique Mercator maps which we were able with the aid of the grant from the Leverhulme Trustees to construct, and which we have, not indeed on sale, but to give to people technically interested. Three of the six were shown: great circle routes discussed above are collected on No. 1, reproduced in part.

Having made the course that is straightest, you naturally want to turn the two dimensions into three dimensions. In a map of Europe and the Middle East (British Council Map No. 1) which was drawn in this Society and published last year we have, I think, thanks to the skill of two of our younger draughtsmen, represented very successfully the third dimension. It has been done in three different ways: by figured contours, by layer colouring, and by hill shading. Upon a copy of that map, exhibited but not reproduced, I have put a number of the most probable air routes, not in detail, but simply joining the points. For example, London–Malta–Cairo–Karachi. You will see in that map a great deal about the geography of the London–Peiping route from the point of view of avoiding the more difficult kind of mountains and deserts. I have just one more illustration which is a rather peculiar example of what people are always asking for, that they should have a map showing the whole world centred upon a chosen point, with the distances and bearings to any other point correct. There are disadvantages about doing it in that way, because on arriving at the antipodal point one is faced, not with a point, but with a complete circle. The antipodal point of Valparaiso, for example, is near Chungking; the whole circumference of the map is Asia, in which you can recognize nothing, and the rest of the world is included as islands and lakes within Asia.

The PRESIDENT: We are all very grateful to Mr. Hinks because he has made some of the points raised by Lord Brabazon easier for laymen such as myself to understand. Now that we have at the back of our minds the maps that Mr. Hinks has brought before us I shall ask Sir Henry Tizard to be good enough to give us a few observations.

Sir HENRY TIZARD: I have only recently returned from Australia by air. Lord Brabazon's remark that Gander is a very good stopping place caused me some amusement. I found it, unfortunately, too good a stopping place, having to stop there for a considerable time waiting for good weather. The only consolation I had was that once somebody had to stop there for seven weeks, whereas I stopped only for three days. I do not recommend it as a stopping place for anybody: and until we can get over the necessity for stopping there I do not think the transatlantic voyage will be particularly popular in peace time.

I quite agree with Lord Brabazon that we shall have to give a great deal of attention to the Atlantic route. It is difficult to think of a more important passage by air from our point of view; and from the point of view of science it is also extremely interesting because if we can achieve regular, and safe, and not too expensive journeys by air across the Atlantic all the other problems of air

transport become relatively easy. So it is a good problem for concentration of effort: I am confident that it can be solved.

I have been wondering what the Royal Geographical Society, so famous for promoting exploration in the past, could do to help in this sphere. Can the Society promote or encourage meteorological studies? A better knowledge of the state of the atmosphere at great heights is of special importance. It may be that all Transatlantic flights of the future will be carried out at great heights; the most dangerous part of all air travel is in the regions where bad weather occurs.

All the technical problems of Transatlantic flight are soluble, even the problem of icing up, to which Lord Brabazon is right in drawing special attention. But the economic problems must be solved too. I think it is true to say that although the velocity of the wind increases, on the average, very much with height up to the stratosphere, it may decrease greatly in the stratosphere itself. It may therefore be of great economic advantage to fly from east to west in the stratosphere, and from west to east at somewhat lower heights.

Now I am going to challenge Mr. Hinks. Are we considering the problem of air maps in the right way? Mercator's projection was originally produced for the benefit of navigators—*i.e.* for a few persons who studied the subject in great detail. Many kinds of maps might do for an air navigator when he knows how to use them and to make allowance for their shortcomings. There is a difference between a map suitable for a navigator, and a map suitable for the purpose of educating people who are not navigators. Mercator's projection gives ordinary people a wrong view of the world; and I am not sure that the maps that were shown on the screen are very much better from this point of view. They may be better for the expert navigator, but are they suitable for general education?

From the point of view of guiding the policy of air routes after the war, I think it is important that we should be supplied with maps which will enable the inexpert to understand more easily the problems which are obvious to the expert navigator, without the contortions which are unavoidable if they are to understand Mercator's projection, or, for that matter, the oblique one. From one of Mr. Hinks' maps it appeared that the shortest route from England to New Zealand was across Russia and China; but I should say that there is very little to choose between that route and the route across the North Pole. The oblique projection gives no indication of this.

When Empire routes are being planned the important thing is surely to show what are the shortest routes which will come closest to towns or other places of commercial importance. Navigators, who have to do the work in the aircraft, have to be specially educated, and oblique projections may suit their needs very well. But from the point of view of educating the nation on the importance of the main air routes we want different kinds of maps, which need not be scientifically accurate.

The PRESIDENT: We have with us to-night one of the greatest pioneers of civil aviation. I believe that already in 1919 Sir Alan Cobham carried ten thousand passengers. Since then he has flown all about the world, and we should greatly like to hear him in our discussion.

Sir ALAN COBHAM: I am afraid my knowledge of these subjects is very elementary indeed, and I find that Sir Henry Tizard has said much that I wanted to say. First of all, in thinking about the great circle routes, we in this room must naturally think about the routes with which this country is concerned. I do not think we are going to be very much concerned with them for the immediate post-war programme, because apart from the North Atlantic route and the

air route to Australia, most of the British air route interests go southward where trade conditions might interfere with the adoption of a great circle course. The North Atlantic route might offer a good opportunity for a great circle course, but for flights over the North Pole the opportunities lie with the United States of America in opening up communications between that country and China. Our great circle route to Australia goes via Moscow, Eastern Turkistan, over the Gobi, down through Mongolia and the Philippines to Darwin, and I am not sure whether we are ready to go to these places immediately. If it were possible to go to Australia non-stop, we might contemplate it, but that is a long way off, and as we have to land on the way, we have to consider the difficulties and cost of getting fuel supplies to Eastern Turkistan and the Gobi.

I have been looking at these routes lately, and I have found that there is only about 450 miles' difference between the great circle route from London to Melbourne via Siberia and China, and the route through Karachi to Australia, and I am wondering whether it is worth while to go round the north of China to save some 450 miles on a 10,000-mile journey. The good old trade route to Australia, by which one wandered around the Persian Gulf and Calcutta, is about 12,000 miles.

I believe the economic non-stop flight to be about 2000–2500 miles, with feeder services for the intermediate towns. Between 200 and 250 m.p.h. should be the economic cruising speed for the next five or six years. Later on it may be pushed up to 300 or even 400 m.p.h., but for the post-war period we must think of cruising at not more than 250 m.p.h.

Reviewing the main air routes we shall have to give consideration to the great circle route to China, which takes us via Moscow. We must take weather conditions into consideration. To-day many people are talking glibly of flying at 20,000 feet, assuming they can then pass over any mountainous districts. But the mere fact of flying at an altitude a few thousand feet higher than the terrain does not necessarily get over the difficulty. Flying over the sea at 20,000 feet and flying over say the Alps or Himalaya at 20,000 feet are two totally different things. Therefore we must always give consideration to weather conditions, and must not assume that by flying high we can avoid bad weather. A sailor does not like to go through bad weather conditions just for the fun of it, and in turn, we must consider whether or not it is worth while to make a short cut through bad weather in preference to a slightly longer journey through fine weather. A few miles may be saved by the great circle route to Karachi, taking one over the Carpathians and Central Persia, but I remember setting out with the late Sir Sefton Brancker, and when we got as far as Warsaw we encountered weather conditions that even to-day would hamper the efficient operation of air transport. Thus we had to forsake our great circle track and fly south to get into better weather.

The North Atlantic air route is no doubt the greatest of all time. There is more traffic between America and Europe than anywhere else in the world. But it is a questionable point whether great circle routes over the North Atlantic will be adopted, because the mileage saved may not be worth the difficulties encountered through icing conditions, high winds, and suchlike met on a northerly course. A more southerly route may be a far more economic proposition. On the route via the north-west coast of Africa to South America we get delightful weather and the full benefit of the trade winds, while, coming home, we can fly high and be out of the trade winds, thus having an easy passage.

Another interesting route is to Egypt and East Africa, which can be operated in 2300-mile hops with one landing at Cairo. The route to India will in all

probability be via Central Europe to Turkey, thence to Baghdad, and along the Persian Gulf to Karachi. From Karachi the route to Australia might be direct across India to Singapore, the Dutch East-Indies, and Port Darwin. Possibly Calcutta will not be on the main route, but may be served by a feeder line.

I do not agree with Lord Brabazon on one or two of his points. He talked about flying being uncomfortable. It has no right to be uncomfortable; it ought to be very comfortable. He said that it was boring; it should not be boring. If it comes to that, I can think of nothing more boring than a long journey in a train. If you are up 20,000 feet I can imagine a lot of people being very bored indeed, because little may be seen of the earth below, the only view being varying cloud vistas. The travelling public may change their views as time goes on, and may develop a taste for getting about the world quickly by air. I have been trying to find out recently how many hours a person can stay in the air and what length of journey he can undertake. There is a habit of sending out questionnaires on all sorts of subjects in order to enable the expert to know what the public wants. My opinion is that the public does not necessarily know what it wants, and it is the responsibility of the operator to define what the public is going to want long before the public has thought about it. Similarly, we should not ask the public how far they want to fly; that is dependent entirely upon the conditions the operator is going to make available. Flights of twelve to fifteen hours can easily be endured under comfortable conditions, with a pressure cabin, well heated and in a smooth atmosphere. To-day there are numbers of people, old and young, who spend twelve hours in a third-class railway carriage, travelling from London to Scotland. If they can stand that, the average individual can stand twelve hours in a luxury air liner.

I could say much about icing. I suppose that the work which is being done at the present moment is very secret. But this matter has been tackled by all sorts of people for quite a long time. There are all kinds of ice, and the more the problem is studied the more complicated it becomes, and the more one listens to tales of pilots, the more difficult it appears to combat.

At one time we had hopes of combating icing by covering the wings of an aeroplane with liquid chemicals and many tests were carried out, but eventually it was discovered that although this system cured icing on many occasions, it was not infallible because it was capable of coping with only one sort of icing conditions, and unfortunately there are many different types. Perhaps the best method of de-icing an aeroplane is the application of heat to the surface of the affected parts, *i.e.* wings, tailplanes, control surfaces, fins and such-like. It is quite possible to take the heat from the engine exhaust and transfer it to all parts of the aeroplane, but the transfer of heat is a difficult mechanical operation, and is also a big mathematical problem if the heat is to be conveyed in the proper amount at the right temperature all over the aircraft. The heating must be pure and free from gases, and this calls for an effective heat interchanger that can use the heat from the exhaust pipe to warm up pure air for distribution to various parts of the aircraft. The work on de-icing is going ahead, and I am sure that before very long we shall have effective apparatus which will cure that very big trouble.

Dr. DUDLEY STAMP: In this discussion we have been regarding the British Isles as the centre of the world, but the point about the great circle routes is that, we may hope, they will afford the lines of aerial communication between the great centres of the New World: Boston, New York, Washington, Montreal, Ottawa, and the countries of Europe. In the old days we benefited by being in such a position that the ocean-going ships from the ports of northern Europe,

passing down the English Channel, had to pass our shores. Thus we had the immense advantage of being situated automatically on the main routes of transatlantic travel. If one measures the great circle routes from practically any of the capitals of northern or central Europe to North America one finds that those routes pass across the British Isles. I do hope that in planning for the future we shall look to our geographical opportunities as being the port of call between the New World and the Old. That is where the geographical advantages of the world position of the British Isles should be appreciated.

Professor AUSTIN MILLER: I should like to add one word in support of what Dr. Stamp has just said. Britain has hitherto been a terminus of air lines, but in an era when the cruising range is transoceanic she will become a junction of transcontinental and transatlantic air routes.

I quite agree that the question of availability of freight and passengers is more important than that of distances on the map. But if we do concern ourselves with distance saved we must be careful to measure our distances through the air and not on the ground. These great circle routes have been considered as ground distances, but we fly through the moving air. If you consider the Atlantic crossing as 2000 miles, and assume a cruising speed of 200 miles per hour, the time taken in still air is ten hours. But if, as may be the case, there is a westerly wind of 50 miles per hour the eastbound crossing, at an airspeed of 250 miles per hour, would occupy eight hours, while the westbound crossing, at an airspeed of 150 miles per hour, would occupy over thirteen hours. The difference in time, five hours, if re-converted into actual miles through the air, represents a saving of 1000 miles. In other words, the distance across the Atlantic may be 1000 miles shorter down-wind than up-wind. By careful study and selection of route you can utilize the most favourable winds and by selection of operational height can often discover favourable winds in both directions over a route. A first essential therefore is a three-dimensional wind-map; you must know your air circulation at different heights and be able to calculate the saving of flying time that can be effected. These completely put in the shade the order of savings that may be made by the use of great circle routes as compared with rhumb-line tracks.

Mr. S. ROSENBAUM: Sir Alan Cobham spoke of China as off the direct route. Surely contact with China after the war will be very essential.

Sir ALAN COBHAM: I was wondering whether it would not be preferable to go via India to Australia than to take the great circle course over the Gobi, China, and the Philippines (difficult terrain) in order to save 400 miles. Our air communications with China could be maintained by a branch line from India.

The PRESIDENT: Marshal of the Royal Air Force Sir John Salmond did us the honour of calling last Friday to inquire about methods of great circle routes, and he is with us this evening, but I understand he does not wish to speak. To conclude our evening the British Overseas Airways Corporation have lent us part of their film "Singapore to London." We have not been able to secure a pilot who knows that route to describe the film, but I understand that Sir Alan Cobham is willing to help us in that respect. While the film is being got ready for projection there is an opportunity for any members of the audience to raise questions.

Part of the B.O.A.C. film "Singapore to London" was then projected, with a commentary by Sir Alan Cobham.

The PRESIDENT: We have seen in this film some of the more picturesque side of air travel, and we have had a very interesting, and I think I may say fruitful, discussion, which will be of great value to the Society. Whatever may be the relative merits of great circle or oblique Mercator or ordinary mapping they will all play their part in the development of future air travel. I am sure we are all agreed that it is air traffic that is going to dominate the world in the immediate future. This Society is very grateful to those great experts who have spoken to us out of their knowledge to-night, and on behalf of the Fellows of the Society I desire to express to them our most grateful and sincere thanks.

Note by Mr. Hinks in reply to Sir Henry Tizard

It is difficult to agree with Sir Henry that the normal Mercator chart is for a few specialists: it is used by every sailor who sails by a chart. The oblique Mercators have precisely the same distortions as the normal, at the same distances from the central axis, but they show aspects of the world, especially relations across the Poles, that the normal Mercator cannot show. The Obliques are essentially small-scale maps, each representing a belt of the world 140° broad. They are not intended for air navigation; still less are they intended for the man who does not care to understand them, but prefers a map much more like one he has been accustomed to. The oblique Mercators and the transverse graticule are for staff work, for planning, not for actual use in performance, which requires a lesser extent and a much larger scale. In planning a world route it is surely desirable to know first which is the shortest way and distance between its terminals. One can then work out how to divide the long route into shorter stretches, of economic length, between desirable ports of call, avoiding high stormy mountains and bad weather, but bearing some reasonable relation to the nearest way, the great circle. One hears tell of planners who demand large expensive globes with elaborate transparent adjustable shells to slide over them, and indicate lines of equal bearing and measures of distance: costly, cumbrous, and with the serious defect that one cannot make a tracing on them as a record of the solution found, nor see the whole of a long route at once. The oblique Mercator can do all that the globe can do, more comfortably, more rapidly, and more permanently.

And now for the simple person who wants to see the whole world drawn round himself in the centre, wherever he may happen to be, with all the bearings and distances from that centre shown on radiating straight lines instead of curves: the zenithal or azimuthal equidistant projection. Such a map is costly to calculate and more costly to draw, with any accuracy of outline. But it is very simple to lay out upon the appropriate oblique Mercator the curves of equal bearing and distance, from any centre, and then not difficult to redraw each compartment upon the desired azimuthal projection, with the home town as centre and the world displayed about it: very simple with the oblique Mercators and transverse graticule as convenient tools, but very troublesome otherwise.

THE ARTISAN ELEMENT IN THE SLAV COUNTRIES

MRS. J. A. STEERS (H. G. WANKLYN)

IT is hard to arrive at a satisfactory definition of the word "artisan," although it is very widely used.[1] For the purposes of this paper the following rather clumsy interpretation of the term "artisan element" used in the title must serve: "the groups, large and small of skilled, semi-skilled and unskilled whole-time workers in the occupations of manufacture and trade, which have developed from the end of the eighteenth century onwards out of earlier communities of craftsmen or peasants, or from a combination of the two."[2] The terminology in this definition is, of course, imprecise, and the words "peasant" and "craftsmen" especially are capable of many interpretations. There is no clear nor permanent distinction, when it comes to the actualities of life, between the peasant and the craftsman, nor between the craftsman and the artisan. Everyone is familiar with the commercial interest of many mountain farming communities, whose spare time is profitably filled with wood-carving, clock-making, or textile manufacture. Again, before 1914 the toy-makers of upland Saxony carried on a highly organized trade with the United States: they were craftsmen in their skilled and laborious production, but as shrewd as any urban community in their trading outlook.

There is however general recognition of the distinction, say, between the potter at Modra, in Slovakia, working on his small oven stoked with wood fuel, and the employee of the big enterprise at Stoke, or between the coppersmith of Bosnia and the brass-worker of Birmingham. The dividing lines between the different classes of producer are bound to be blurred, and no test of size of enterprise, part or whole-time occupation, division of labour or range of market is really discriminating. The extremes however are clear, and the distribution of the less developed and more developed methods of production in Europe forms one theme in this paper.

Artisan groups in the sense suggested above quite plainly did not grow with equal vigour or simultaneously in all parts of Europe. To a limited extent, certainly, every European country experienced an increase of artisans, above all in the last quarter of the nineteenth century; but it is common knowledge that one particular region in North-Western, and Central Europe especially, was favourable to the growth of this element in the population. The belt of country with its north-western extremity in Central Scotland and its south-eastern tip in Upper Silesia became during the nineteenth century the most densely settled zone in Europe with trading and manufacturing activity based mainly on the wealth of the underlying coal measures.[3] In this region where

[1] The definition in the *Shorter Oxford English Dictionary* (1933) is "One occupied in any industrial art, a mechanic, handicraftsman, artificer."

[2] The comments on the development of the artisan class, whether in Europe or the New World, belong, inevitably, mostly to the great formative period of modern industry 1815–1914. But there must naturally be many allusions to earlier economic history and to the generation of recent history between the two world wars.

[3] Countries without extensive coal resources, like Denmark, Holland, and Switzerland, should be included in this strip of extreme industrial importance.

both immigration and reproduction combined to make a phenomenal rise in density of settlement, the most pronounced element was the artisan. In this respect, part of North-Western and Central Europe began to stand distinct from the Mediterranean lands of ancient and medieval trade and manufacture, from the scantily populated north, and from the predominantly peasant countries of the east, the last forming the region of food supply and raw materials [1] for the thickly inhabited areas.

In the belt of extraordinary industrial growth there remained naturally much farming activity and many peasant groups. But the preponderance of the artisan and town-dweller was plainly reflected in the methods of tilling and of animal husbandry. The north-western and central zone became one of amply capitalized intensive farming, whether in large or small units, in which producers were well aware of the near-by urban markets. To the east, in contrast, lay the wide territories of the Slavs, the Romanians, and some of the Magyars: lands with an export of grain, it is true, but yielding less per acre both on account of climatic conditions and of traditions in outlay, method, and marketing.

Within the great strip of artisan development lay two regions of Slav occupancy, the Czech and west Polish settlement areas. The inhabitants of Bohemia, Moravia-Silesia, south-western Poland, and to a lesser extent, Slovenia, felt the impact of capital and of growing mechanical skill.[2] But outside the industrial belt lay the great majority of the Slavs, that is, the Croats, Serbs, and Bulgars of the Balkan Peninsula, the Slovaks and Ruthenes of the old Kingdom of Hungary, and the bulk of the population of the former Russian Empire, Poles and White Russians, Great Russians and Ukrainians.[3] In spite of the increase in trade and manufacture in Imperial Russia, in Hungary, and in the Balkans in the generation before the 1914–18 War, the comparative weakness of the artisan element amongst the Slav groups remained pronounced.

Circumstances after the first World War tended, perhaps, to lessen this economic disparity between Eastern Europe and the centre and west of the continent. The growth or restoration of new political units, three of which were Slav, with tendencies to autarchy and with great anxiety to justify

[1] The East European regions were different in their economic inertia from the Mediterranean lands, or from those of the extreme north. In the Mediterranean region there is a real, and to some extent insuperable, lack of resource which provokes a unique set of economic and political difficulties. In Fenno-Scandia the limitations set by high latitudes are severe in spite of the marked progress of the last hundred years. In the East, as is mentioned later (p. 111), resources are rich and varied. Economic immaturity in the Slav lands thus needs some explanation.

[2] In another fashion also all the Slav peoples felt the effects of rapid and thorough industrialization. Millions of them migrated to North America in the nineteenth and early twentieth centuries, and almost all flocked to the great cities. There the conditions of the industrial zone in Europe were if anything intensified, and the indirect effects of this new environment on the peasant populations persisting in Slavonic Europe have not, perhaps, been sufficiently appreciated.

[3] The terms "Ukrainian" and "Ruthene" (and Little Russian) are roughly synonymous. "Ruthene" is often used to describe the majority group in Sub-Carpathian Russia, Ukrainian to denote the same linguistic group north of the Carpathian Mountains.

political independence, favoured a more even distribution of manufacturing and trading effort and fresh nuclear artisan groups. Moreover the most remarkable industrial experiment of modern history, the Soviet, was the product of Slav peoples. But a survey of the occupations of the peoples of Europe in 1939 would still have shown the diversities already mentioned, the strength of the artisan element in the North-West and Centre, and the relative immaturity of this class in the East.

What is the object of pointing out and examining this contrast between the majority of the Slavs and the peoples of North-Western and Central Europe? In many respects such an inquiry and the answer to it seem platitudinous. The majority of Slav peoples, without strong and growing artisan classes and all that such development signified, plainly enough lacked one factor which made the countries of North-Western Europe and the United States continuously forceful units in world history of the nineteenth and early twentieth centuries. But the point, however obvious, is of immediate concern to-day to the whole world, and can well bear further discussion (see pp. 117 to 119).

This form of immaturity was the more conspicuous because of the neighbourhood of the Slavs to the Germans. In the German-speaking lands the original strata of craftsmen and peasants, from which the later artisans were evolved, had peculiar strength. This derived in part from the stimulus of pressure. The wide areas of poor soils meant great limitations to farming: many German peasants had thus for centuries sought supplementary occupations to tilling and pastoralism. It came also from the possibility of German whole or part-time craftsmen working a wide range of mineral resources. None of these, except for the fossil fuels and potash, was sufficient in bulk to signify greatly in modern industrial activity, but there was enough variety in type to provide many and precocious kinds of experience in metallurgy and elementary chemistry.[1] Moreover such resourcefulness had in a sense been intensified by the exaggerated self-sufficiency of the small German states after 1648. Regionalism indeed depressed the quantity and quality of production in the German lands in comparison with the vigorous progress in Great Britain, France, and the Low Countries in the eighteenth century, but in every German state there was maintained from force of circumstances a population of craftsmen, accustomed in many cases to substitute skill and economy for abundant or suitable raw materials. In the nineteenth century the whole force of this accumulated energy and ingenuity was released and spurred on by the consciousness of national unity, of advantages of position, and of available capital. The speed and power of German economic advance staggered the inhabitants of the Western European states, those who had so far led Europe in mechanical skill and commercial technique. On the east, the contrast between the Germans and Slavs was glaring, and due not only to the comparatively simple economies of the Slav peoples, but also to the almost breathless rush of German development. The gulf in economic standards between the two big linguistic groups, excepting always the Czechs and western Poles, was measured roughly by the relative strengths of the artisan classes in Central and Eastern Europe. In the German lands the

[1] See Benaerts, 'Les origines de la grande industrie Allemande,' Paris, 1933.

artisan element, if easily dragooned, had become in an incredibly short space of time one of great numerical, economic, and political importance. In the Slav lands, the artisans remained comparatively small minorities playing unimpressive parts in national economies.

Such happenings served to strengthen one conception of the Slavs which was widely accepted at the end of the eighteenth century and which died hard. It was based largely on studies of ancient Slav history, philosophical and imaginative rather than scientific in method, but not without effect on contemporary opinions as to the competence and future of the Slav peoples. The German philosopher Herder [1] apprehended and described the early Slav communities as gentle and passive, destined neither to the military distinction, nor to the planned economies, which in his time had led to the hegemony of Prussia in the German lands and to German territorial conquests in Slavonic Europe. Herder's conception of the Slavs was evolved in a spirit of admiration and not of enmity, and his ideas were readily taken up by Slav scholars a generation later, for example by Šafařík,[2] the Slovak scholar who belongs to the Czech literary revival of the early nineteenth century. All were attracted by the picture of the Slavs as peace-loving and unambitious groups, content with simple economies and innocent of aggressive designs against their neighbours, although it scarcely harmonized with the contemporary vigorous expansion of the Muscovite rulers. Such a theme persisted, as any student of Slav civilization can see for himself, in Peisker's widely read presentations of the Early Slavs,[3] published at the end of the nineteenth and the beginning of the twentieth centuries, and the reaction to this idea was slow. The German historian Schlözer,[4] in the first decade of the nineteenth century drew, it is true, upon the medieval chronicles of German-Slav struggles to stimulate the idea of the ferocious savagery of the eastern neighbours of the Germans. But it was the Slav philosophers and historians of the last fifty years only, for example, Soběstianskiij [5] and Niederle,[6] who rejected alike the German-Slav assumption of Slav passivity and economic inertia, and the German tale of savage hordes incapable of the higher levels of material and cultural well-being. Their efforts were the more commendable and intelligent, because on superficial counts there was so much in the records of the Slav peoples to suggest the inferiority implied with ever-increasing eagerness by German scholars.

Eighteenth and nineteenth century scholarship suggested a temperamental difference between the two linguistic groups which may have been a fertile

[1] J. G. Herder, 'Ideen zur Philosophie der Geschichte der Menschheit,' Book XIV, chapter 4, 1791.

[2] P. J. Šafařík, 'Slav Antiquities,' published in Czech in 1837, and in German in 1843.

[3] J. Peisker, "The expansion of the Slavs," 'Cambridge Medieval History,' vol. II. Cambridge: University Press, 1913.

[4] R. Schlözer, 'Russische Annalen,' I, pp. 33 ff. It was Schlözer's account of the bestial ferocity of the medieval Slavs in their resistance to the Germans which inspired Czech and Slovak nationalist scholars to accept and propagate Herder's suggestion of the harmless and acquiescent Slav peoples.

[5] J. M. Soběstianskiij, Kharkov, 1892.

[6] L. Niederle, 'Manuel de l'Antiquité Slave,' vol. II, Paris. Librairie Honoré Champion, 1923.

theme for philosophical reflection, but which was to prove unsound in the long run, if translated into contrasts in manufacturing and trading potentialities. Further, the misuse of simple anthropology, which had such strong political repercussions after the mid-nineteenth century, piled on to the misconceptions of early history what might be called a racial interpretation of Slav development. Such a suggestion was, of course, quite erroneous: for the anthropologist, there is no such thing as a Slav race, and the fact that the dividing line between the strong and weak artisan elements in Central Europe runs *through* the Czech and Polish settlement areas, and not to the west of them, should have been significant. There is a positional interpretation of the differences between the main Germanic and Slavonic speaking peoples, which is well worth study and which is outlined in this paper (see pp. 111, 112), but it has come to the fore only very gradually. Throughout the course of modern history, attention has been focused on the existing disparities between the two groups, and especially in their attitude to the use of natural resources. And such disparities were reflected naturally enough in the occupational distribution of the populations.

These trends in scholarship are, of course, the more regrettable in that they result in observations on the Slav peoples which are negative rather than positive in character. To trace the growth of German mastery of environment through the rise of the artisan element from the strata of peasant and peasant-craftsman is rewarding. But in the case of the Slav groups, with the possible exception of the Czechs, the main theme in the study of human adjustment to, and exploitation of, geographical setting, is that of the predominance of simple farming. To concentrate on the limited artisan element in the Slav countries is to force attention on a minority class, on one of the weaker factors in political and economic growth, and to risk drawing a picture of the Slav groups in the wrong proportions. These drawbacks need remembering in the working out of the arguments which follow.

Three aspects of the economic structures associated with the Slav groups show the ease with which both scholars and entrepreneurs with practical business interests might tend to regard the Slavs as primitive peoples for all time. These are the character of Slav trade during centuries of European commercial history, the role of the foreigner in Slav economies, and the meagre growth of the towns in the eastern Slav lands. The most fervent of Slav scholars admit the limited nature of Slav trade and manufacture at all stages of historical and economic development. Milioukov [1] points to the revealing character of Slav trade in general in ancient and medieval times, and of Russian trade in particular up to the end of the seventeenth century. Whether with the merchants of the Byzantine Empire, or with the medieval Hanse groups, or with the Dutch and English traders of the White Sea settlements in the sixteenth and seventeenth centuries, the type of exchange was the same. There was the export from the Slav lands of foodstuffs or raw materials, honey, grain, furs, beeswax, hides, timber, flax, and hemp, and the import of small quantities of expensive manufactured goods for the few who

[1] P. Milioukov, 'Essai sur l'Histoire de la Civilisation Russe,' Paris, Giard et Brière, 1901.

could afford them. Such commerce suggested correctly a population, in the Mediterranean world to begin with, and later in Western and Central Europe, supporting craftsmen who could manufacture for export and merchants eager to make use of the raw materials and limited market of the great undeveloped regions of the north-east of the Continent.[1] In that region of colonial enterprise in contrast persisted groups largely of part-time craftsmen, working almost entirely for their immediate needs and those of their neighbours, with very little knowledge of, or interest in, long-distance trade unless and until the merchant explorer arrived in the neighbourhood. Indeed the very commodities for which the Slav lands were famous in the Old World were mainly collected and despatched by isolated settlements of foreign merchants. The famous Varangian Way of the Early Middle Ages ran through the Isthmus of Europe, settled mainly by the Slavs. But the active traders were Greeks, Arabs, and Jews in the south and Norsemen in the Baltic drainage area. The Slav contribution to, or profit from, this trading route was very small. In the later Middle Ages the Germans were active in the north, the Italians (Genoese) in the south, and after the beginning of the fifteenth century the number of Jewish intermediaries increased rapidly. Once this type of exchange was established, and especially once the small communities of foreign merchants had taken firm root, the commercial relationships between the Slavs and their neighbours were difficult to alter. It was as hard for the peoples of Eastern Europe to change their roles of suppliers of food and raw materials as it has been for some groups in the British Commonwealth in modern history to get to the stage of manufacturing goods rather than exporting raw materials and importing finished wares.

In itself the character of Slav trade with the outer world was no proof of inability to manufacture a wide range of necessities and even luxuries. Many scholars in the last hundred years, and Niederle [2] in particular, have described the two great classes of Slav craftsmanship. There were the producers in every village of the implements of subsistence, of ploughs and spades, millstones and sickles, harness and fishing harpoons and nets. There were further the spinners, weavers, and dyers of wool, flax, and hemp, and the workers in precious metals, such as the coppersmiths of Bosnia, and the silversmiths of Bohemia. The purely Slav terminology for such metals as gold, silver, iron, and lead show that mining and metallurgy were not wholly in the hands of immigrant Germans. The legacies of ancient and medieval Slav workmanship moreover show a sense of design and skill in construction which are satisfactory both aesthetically and practically, and such achievements could have formed the foundation of the overwhelming industrial growth experienced farther west in the nineteenth century. But at the same time there were signs of limitations. Craftsmen with long-distance reputations such as the

[1] To this very general statement the obvious exception must be made: Throughout the greater part of Mediterranean commercial history in the Middle Ages, the semi-autonomous Slav community of Dubrovnik (Ragusa) played a distinguished part in manufacture and trade, showing a skill and enterprise in long-distance trade comparable with the Venetian. The record of that city state should leave no doubt of Slav competence, given the requisite circumstances of position, juxta-position, and resource.

[2] Niederle, *op. cit.*, vol. II, chapters 8 and 9.

Ikon painters of Suzdal, and the locksmiths of Pavlovo, who travelled all over Holy Russia, were comparatively rare. Craftsmanship persisted for centuries at one stage of evolution, that of supplying personal and local needs, whereas that in the rest of the Continent and especially in the north-west developed quickly both in technical skill and in close association with organized long-distance trading activity.[1]

Milioukov, using the memoirs of the Dutch merchant, de Rodès, and the Swedish merchant, Kilbourghère, describes the change in the character of Russian trade in the seventeenth and early eighteenth centuries. During that period manufactured goods figured in Russian export trade as at no other time. This development has various explanations, the second of which bears out again the truth of the comments already made on Slav economic history. In the first place it was connected with the growth of shipbuilding in North-Western Europe. There was a growing demand for ropes and sail-cloth made from Baltic flax and hemp. In the second, the Russians were acquiring with the conquest of the Baltic, not only an outlet to the sea, but also non-Slav populations, whether German, Swede, Estonian, or Lett, of proved economic competence in farming, manufacture and trade (see also pp. 108, 111). In the third, the years of territorial advance on the part of the Tsars and Tsaritsas were ones of corresponding political weakness for the Germans. In the nineteenth century the proportion of manufactured goods in the export list fell sharply, but mainly because the small class of Russian artisans was working for the home market. The volume of raw materials *imported* for the use of manufacturers in Russia increased steadily, showing a growing interest in supplying the indigenous peasant population.

Dyboski, the Polish historian, in his 'Outlines of Polish history,'[2] comments on the second aspect, the grip of the German traders on craftsmanship and trade in the Slav lands at a very early date. He points out the wide acceptance of German commercial law throughout Eastern Europe even where German settlement was only of a minority character. And not only amongst German colonists and their suppliers, but also amongst Slav or Magyar traders and craftsmen, German precedents and practices were widely accepted.

The growth of Jewish influence of trade and manufacture in the Slav lands of the Isthmus of Europe is too large and complicated a subject for satisfactory treatment in this paper.[3] Its effect was indeed enormous, and in a sense the Jewish concentration on these forms of economic activity was as stultifying to enterprise amongst the Gentile Slavs as the predominance of the Germans. But at the same time, it is legitimate to ask whether centuries of settlement in the Slav lands, together with a very general use of the Slav languages, did not put the Jewish groups into the category of Slav producers and traders.

Less widely recognized, but equally significant, and from the point of view of the geographer, extremely interesting, was the persistent importance of Greek artisans and traders in the littoral towns of the Black Sea. The Great

[1] See Milioukov, *op. cit.*, Part II, chapter 3.

[2] R. Dyboski, 'Outlines of Polish history,' Lecture I, Section 6, London, 1931.

[3] See H. G. Wanklyn, "Geographical aspects of Jewish settlement east of Germany," *Geogr. J.*, vol. 95, 1940.

Russians shifting gradually southwards from Muscovy during the seventeenth and eighteenth centuries reached at last the goal of the southern coast at the expense of the Tartars and Turks.

The last phase of the struggle was the most difficult, the crossing and mastery of the dry steppe region which forms the hinterland to the northern coast of the Black Sea.[1] Such a region offered neither food nor water nor fuel for long drawn-out campaigning, particularly in the drier east. Nor was it possible in this zone to follow up military conquest with the peasant and trading settlement which had been part of the cycle of conquest in the well-watered steppe-land lying to the south of Muscovy. The Cossack bands of adventurers had formed the spearheads of pioneer movement south, following the direction of the great waterways, and groups of peasants had consolidated military gains, gradually reclaiming the pastoral territories of the Tartars for primitive forms of arable farming. But between the well-watered grassland and the littoral lay a belt of arid steppe, increasing in width towards the east, and until the Soviet experiments in dry-farming of the twentieth century, this belt remained the preserve of the Tartar herdsmen and shepherds. Fortunately for the Great Russians, there was established on the Black Sea coast the remnants of an ancient trading and manufacturing population, part Greek, part Armenian, part Jew, and part Tartar, the last deeply influenced by centuries of intermarriage and trading with the Mediterranean peoples. To this nucleus there migrated quickly, after the Russian conquest, a second stratum of commercially-minded Greek settlers, attracted from the Christian subjects of the Ottoman Empire to the Eastern Orthodox conquerors of the north.

The history of the Greek Wars of Independence at the beginning of the nineteenth century brings out the full significance of this nucleus of traders and artisans to Russian expansion southwards.[2] Just as in the eighteenth century, the Russian conquest of the Baltic littoral would have meant much less to the Muscovites and to Europe alike, had the Russians not acquired with the coastal territories German and Swedish commercial settlements and the intelligent Lett and Estonian peasants, so in the south, Russian mastery of the Black Sea coast took effect quickly, because the Russians were able to manipulate a well-established trading and manufacturing zone. Once again however the contrast between the Slavs and the peoples fringing their settlement areas was exemplified. Swedes and Germans, Estonians and Letts in the north, Jews, Italians, Greeks, and Armenians in the south, all had greater predilections towards trade and manufacture than the majority of Slavs.

Two aspects of the continued immaturity of Slav economic development are thus plain and generally accepted, the character of Slav trade with other groups, and the firm grip of non-Slav elements on trade and manufacture in

[1] A. M. Gillett, "A sketch of the historical geography of the Black Earth region of Central Russia," *Scottish Geographical Magazine*, vol. 38, 1922.

[2] W. Allison Philips, "Greece and the Balkan Peninsula," 'Cambridge Modern History,' vol. X, chapter 6. Cambridge: University Press, 1907. It is significant, for example, that the armed secret society of the Greeks, the Hetaira Philike, was founded and flourished at the new Black Sea port of Odessa, where there was a community of wealthy Greek merchants.

many regions of Slav majority settlement. One other is worth mention, the character of the Slav towns, especially in the former Russian Empire.[1]

Milioukov[2] raises some interesting points on town growth in Russia from the sixteenth century onwards. "Avant la ville devint nécessaire à la population," he writes, "elle le fut au gouvernement." Hence the establishment of some curious and rather ominous characteristics in Russian town life. The commercial quarter which adjoined the *gorod* or defensive site was known as the *possad*, and from the end of the sixteenth century until the reign of the German Tsaritsa, Catherine II (1762–96), the citizens of such trading suburbs were as severely bound by law to their dwellings and occupations as the serfs of the countryside.[3] Moreover when manufacture began slowly to increase during the eighteenth century, the institution of the factory serfs in the enterprises owned by the nobility was significant. There was nothing to correspond to the mobile labour supply which was already beginning to play an important part in the industrialization of Western Europe.

Russian towns were thus strategic and administrative centres rather than the spontaneous results of trading and manufacturing vigour. Manufacturing activity, when it began to develop under the Muscovite Tsars, owed its existence to governmental planning and encouragement rather than to widespread individual or group enterprise.[4] A minute bourgeois class grew up in an atmosphere of subsidies, guarantees, and all kinds of protection. Such origins for urban settlement whether for military or economic purposes were not, of course, abnormal. Many towns in all parts of Europe owed their foundation to sites of strategic rather than commercial value and their craftsmen's skill and safety to royal or noble benevolence. It was the extent of control imposed from above upon urban activities, the lateness in time of such planned settlements, and the continued absence of spontaneous economic growth which became noticeable, especially in eighteenth and nineteenth century Europe.[5]

[1] It is unfortunate that the unequality of the sources on Slav economic history leads to a quoting in the next section from Russian sources only. At the same time the paragraph on p. 110 makes it clear that the contrasts between the Slav groups and those farther west and north increases in the eastern Slav lands.

[2] Milioukov, *op. cit.*, Part IV, chapter 2.

[3] G. Plékhanov, 'Introduction à l'Histoire Sociale de la Russie,' Editions Bossard, Paris, 1926.

[4] Such a comment is not true of the great Russian cities of Novgorod the Great and Pskov during the thirteenth and fourteenth centuries. Even though the influence of the Hanse merchants in these west Russian towns was considerable, the continuity of Russian political history was maintained in the two forest city states, between the time of the conquest of the steppes by the Tartars and the rise of the Muscovite rulers. When Novgorod and Pskov were conquered from Moscow, the most vigorous forms of town life, including an artisan element akin to that in contemporary Central and North-Western Europe, were quenched.

[5] This "artificiality" in urban existence is reflected in the original planning of many Russian towns. St. Petersburg was an example of this policy, with its core of the Admiralty buildings, its straight military roads radiating through the city and for miles outside, its concentric blocks of building divided by the roads into segments, each segment allotted primarily to one or more regiments after which the parts of the city took their names. Camena D'Almeida, 'États de la Baltique: Russie,' *Géographie Universelle*, vol. V, chapter 10; Paris, Librairie Armand Colin, 1932. See also Camena D'Almeida's comment on the military origins of the steppe towns in chapters 13 and 14.

Ogarev's remark in the third decade of the nineteenth century is really the most telling of all because of its date: "Pourquoi avons nous besoin des villes? Nos villes n'existent que dans la fantaisie du gouvernement: elles n'ont en realité ni signification, ni force." [1] Later scholars have rightly queried so sweeping a statement,[2] but it serves to strengthen the impression of the weakness of the artisan element in the Slav lands throughout history.

The stultification of the artisan class became increasingly noticeable towards the east, and this gradation in economic structures is understandable. The Czechs, the westernmost of the Slavs, one must remember, formed the main manufacturing element in the Austro-Hungarian Empire; the Poles of Prussia were caught up in the whirlwind of German material development, although their lot in this colossal drive for efficiency was far from enviable. The Slovenes, Croats, and Serbs, even if they remained largely peasant groups, had been stimulated by a variety of influences to a certain extent of manufacturing and trading vigour. All these western groups however were weak numerically and limited in settlement area compared with the combined millions of Bulgars, Poles, White Russians, Ukrainians, and Great Russians, who had small part or lot in the economic hierarchy which was increasing and hardening in Central and Western Europe. In these masses the existence and role of the artisan, as understood in the west of the Continent, were meaningless.

There was still indeed, in the economic make-up of the Slav peoples at the beginning of the twentieth century, a persisting reflection of those powerful dividing forces which Niederle [3] mentions as effective from pre-history. On the west were settled the smaller groups whose homeland had been the basins of the Oder and Vistula rivers, who had been touched in the earliest instance by the Bronze Age and Hallstatt cultures, and later by contact with the Gallic and Baltic groups, and by Roman imperial and ecclesiastical influences. To the east were great numbers of Slavs whose homeland lay originally between the Carpathians and the Dnieper, and whose relations with other peoples had been very different from those of the Western Slavs. Their orientation had been consistently to the east and south; the thread of continuity running through their history was that of defensive and offensive warfare with the Altaic pastoralists: their commercial and cultural contacts were those with the Arabs, with trading and administrative adventurers from Byzantium, and later with the peoples of India and China.

Such arguments in part explain the opinion of some Russian scholars of the relative peculiarity of Eastern Slav history.[4] The course of political and economic development east of the Vistula Basin and beyond the arc of the Carpathians is, in their view, not comparable in many respects with that of the Mediterranean lands, nor with that of North-Western and Central Europe.

[1] Ogarev, 'La Cloche,' No. 51.

[2] Ogarev's remark quoted in Plékhanov, *op. cit.*, was relevant enough to the Russian Empire of 1830–40, but it should be borne in mind that the industrial drive under the Tsarist regime came with great vigour between 1880 and 1914.

[3] Niederle, *op. cit.*, vol. II, chapter 13.

[4] Plékhanov, *op. cit.*, chapters 1–7.

With this suggestion in mind, however speculative and controversial, discussion of the aspects of Slav economies which suggest a permanent addiction to a simple and predominantly rural existence for these groups, yields to another topic. Assuming that Slav development is in the main distinct from that of the groups farther west, it is worth reflecting on the possible explanations of the contrasts, particularly between the Eastern Slavs and the Teutonic and Anglo-Saxon peoples. For the historical geographer, the environmental features of such problems are substantially interesting.[1] In particular it is repaying once again to consider why none but two of the Slav peoples has evolved an artisan element comparable with that in the centre and north-west of the Continent, even taking into account the colossal achievements of Soviet energy and planning in our own time.

In the first place, the fact that the influence of position has more than counteracted that of resources is of some importance. The Slav settlement area is richly endowed, whether from the standpoint of the farmer, forester, or miner. Indeed the contrast between the potential wealth of the Slav lands and the meagre supplies of the German, has been largely responsible for the instinctive hungry nibblings by the Germans at the food supplies and raw materials of their eastern neighbours.

But all the wealth of arable and pasture land, of deciduous and coniferous forest, of precious metals, of coal and iron and oil, was for centuries no compensation to the Slav peoples for their position in Europe and indeed in Asia, and this comment applies most forcibly to the Eastern Slavs. They were in early times too far removed from the trading activity of the Mediterranean world to be stimulated to anything more than the first stages of commercial growth, the supplying of slaves, foodstuffs, and raw materials. They were too much threatened from the east by the Altaic-speaking peoples to develop during the Middle Ages secure settlement areas in which they could experiment with the abundant resources of East Europe. Indeed confinement for centuries to the forest zones, while the Tartars and Turks were in possession of the steppe lands, was bound to cramp the activities of the Russian Slavs. Moreover all the Slav peoples were remote from the regions of active trade and manufacture which developed with the discoveries of the New World and of the Middle and Far East.[2] The concentration of merchants and manufacturers on the western littoral of Europe meant that the groups in the east of the Continent became farther and farther out of reach of the main currents of economic activity. For the same reason the potential abundance of the Slav lands was not exploited through the capital which was accessible to entrepreneurs farther west in Europe and in many parts of the New World. With the exception of Baltic Russia, where the competent and long-established minority of German Balt traders, manufacturers, and landowners kept in close touch with the economic hierarchy of the German Empire, it was late in the nineteenth century before foreign capital, mainly German and British, began to have much effect upon the resources of the East Slav lands. It was

[1] See Seton-Watson, R. W., 'A history of the Czechs and Slovaks,' p. 300, for the comment that geography is the "confirmed enemy of the Slavs," London, 1943.

[2] It is right to recall however that Archangel originated in the sixteenth century from the efforts of Dutch and English adventurers to achieve the North-East Passage.

not until the twentieth century that Russian capitalism had gathered enough force to be really effective in the opening up of the Empire's wealth.

The geographical setting of the great land mass of Asia, which formed in part the sphere of Russian territorial and economic expansion, was also unfavourable to the creation of manufacturing and trading parallel to that in North-Western and Central Europe. The great forest belts of the north, the mountains and deserts of Central Asia, alike offered huge obstacles to movement and settlement. What has been called "the dead heart" of Asia cut off the Slavs effectively from the densely settled lands of India and China. The regions to the south-east of Slav occupancy were commercial blanks. The climatic conditions of northern Asia set a rigid seasonal limit to such occupations as fishing, shipping, and pastoral farming. The flow of the main rivers in a south–north direction towards the Arctic Ocean, and the long period of winter freezing for waterways in a great continent at high latitudes, minimized the value of these natural arteries of communication. Plainly enough the most important line of movement across Northern Asia is east–west. It is expressed in the building and maintenance of the Trans-Siberian Railway which runs in Western and Central Siberia through the zone of arable grassland, at right-angles to the great waterways.

In such circumstances the penetration by the Slavs to Eastern Siberia by the end of the seventeenth century was in itself remarkable. It is an episode in expansion and settlement not yet sufficiently studied nor rightly appreciated in the annals of colonial history. But in the feats of the Cossack bands, and other adventurers, the salt-boilers, fur-traders, hunters, and hand-to-mouth miners and farmers, in the penal settlements for political and criminal offenders, there was nothing to stimulate a supporting and substantial artisan population either in the pioneer fringes or farther west. Even when the Imperial Government had become really alive to the quantity and range of Russian resources, whether in European or Asiatic territories, there was lacking the capital for development to any degree comparable with that in the British colonies or the United States. The diverse histories of railway construction and maintenance in North America and in Russian Asia reflect the contrast between the two great areas of pioneer settlement in tradition, type of immigrant, and in financial and administrative backing.

Even within many of the lands of long-standing Slav settlement, the geographical facts of climate, distance, and difficulty of movement did much to thwart the growth of trade and manufacture along the lines recognized as healthy in the west. Milioukov [1] points out that local craftsmanship and caravan trade, the features of medieval industry and commerce, persisted in Russia precisely because they fitted in so well with geographical setting and traditional farming economies.

Climatic conditions in much of the Empire precluded the cheap and easy transport of persons and merchandise even when the railway system was considered well established. As late as the first half of the nineteenth century the price of transporting goods in summer in regions where wheeled carts were necessary to supplement the waterway routes, was four times that of the winter season when sledges could be used. Such seasonal variations in a

[1] Milioukov, *op. cit.*, Part II, chapters 3 and 4.

country of immense area and unequal settlement plainly encouraged local self-sufficiency in craftsmanship rather than the manufacture and distribution of artisan's goods. Distances were too great for purchasers to buy easily the manufactured goods of whole-time artisans. Moreover climatic extremes in much of Russia and Russian Poland allowed of seasonal farming only, and freed many spare hours, especially in winter, for part-time craftsman's activities. It was not therefore surprising to find in the Russian Empire, even at the beginning of the twentieth century, that the craftsmen still outnumbered the artisans by four to one (four million craftsmen to one million artisans).

What was true of the Russians in Europe also applied substantially to the other Slav groups. The volume of manufactured goods produced in the Jewish Pale of the Russian Empire (which included Russian Poland) was greater in proportion to the population than that farther east, owing to the strictures on Jewish movement, settlement, and occupational activity. The ever increasing Jewish population could only exist as small traders and artisans. But that did not imply the development of a genuinely Slav artisan class, either Polish or Great Russian, of any strength. It was certainly applicable, also, to the Slav groups of the Balkans, especially to the Serbs and Montenegrins of the north-west of the Peninsula and to the Bulgars of the north-east. Climate and distance were not in this part of Europe as emphatically against any progress from simple economies as in Russia, but the rugged highlands of the Balkans were in a different way as hampering as the conditions farther north and east. The great Karst mountains of the west of the Balkan Peninsula were perhaps the most effective preservers of archaic conditions. The barren limestone ranges of great steepness, if not of great height, served to prolong unduly the self-sufficiency of each community which had been accepted throughout centuries of history as a matter of course.

Finally, the very characteristics of natural wealth in the Slav settlement area encouraged the persistence of the tiller and pastoralist rather than the growth of the manufacturer and trader. Much of East Central and Eastern Europe, in spite of climatic problems, has a strong attraction to the farmer, and is rich in great stretches of fertile soil in contrast to the meagreness of the Mediterranean and German-speaking regions. Thus, on a small scale in Bohemia and Moravia-Silesia, the Czech farmer, as the indigenous dweller, for centuries held the fertile loess plains of the Upper Elbe, leaving to the German immigrant the poorer highland rim, and the occupations of forestry, mining, and textile production. On a much larger scale, in the famous Black Earth zone of the Ukraine and Central Russia, the more competent inhabitants persisted as farmers, while the less able alone sought other occupations. This tendency of the unsuccessful peasant to leave the land and of the sturdier type to remain, is traceable certainly in much of rural Europe until the late nineteenth century; but the age-old possibilities of farming in Central Bohemia, in the Croatian–Slavonian plains, in the valleys and rolling uplands of Bulgaria, in the plateaux and lowlands of Galicia and South Central Russia, attracted instinctively the mass of the Slav peoples from one generation to another, in spite of the persistence of primitive methods. Hence the adjustment of the aliens like the Germans or the much larger communities of Jews to complementary and non-farming occupations.

Political and strategic influences no less than geographical, and indeed inseparable from them, tended at all times to frustrate amongst the majority of the Slavs any instincts to copy the economic pattern of the west and centre of the continent. In the first place the migratory activity of the Slavs was unique amongst the peoples of Europe until the beginning of the nineteenth century. This comment is not qualified, either, by the fact that the Slavs did not participate in the great movements of overseas imperialism which developed between the sixteenth and twentieth centuries.

But in early history it was the constant shifting of the Slav peoples, gradually filling the vacuum in Central Europe left by the westward movement of the Teutonic tribes, which prevented them gaining as much as they might have done either culturally or materially from contact with the Byzantine traders and warriors. The lack of a defined and secure settlement area prolonged the very crude stage of their economies.

The later catastrophe of the Tartar conquest of the steppes (1223–43) has already been considered (see p. 111): its effects lasted far beyond the period of Mongol invasion, mastery, and withdrawal. Between the sixteenth and nineteenth centuries, when in the north-west of the continent new economic structures were taking shape, the Muscovites were slowly extending their frontiers at all points of the compass. Such expansion was inevitable, the natural reaction of groups who had been hammered systematically by Tartars, Turks, and Swedes and by their own linguistic kin, the Poles. But it meant the maintenance in East Europe of a sparsely settled population with a tendency to shift towards the periphery of military conquest; regarding town settlements mainly as strategic strongholds and clinging naturally to archaic methods of farming, manufacture, and to occasional buying and selling. The migrations of the expanding Russians were as exhausting economically as the earlier devastations of the Tartars.

In the second place so much of the economic development of the western Slavs took place under the tutelage of alien groups. The effect of this foreign domination was plainly variable. For the Czechs, for example, Austrian administration, although detested, meant the accessibility of capital, and the provision of marketing facilities, two material contributions which helped to make the Czechs more artisan in character than any other Slav people. But under the same regime an archaic economy persisted for the Poles and Ukrainians of Austrian Galicia, and the manufacturing and commercial activity of Dalmatia was deliberately repressed. In the part of the Hapsburg Empire administered from Budapest, Croats, and Slovaks, and Ruthenes all suffered economically from being subject peoples, and the main result of their servitude was the persistence of poor peasant and craftsmen economies, rather than progress towards an intensive and highly organized use of farming and industrial resources.[1]

[1] There are two exceptions to this comment which deserve mention. In the first place, Magyar and Jewish entrepreneurs of the late nineteenth and early twentieth centuries drew largely on the Slav peasants for factory labour, especially in Budapest. In the second, the iron resources of Slovakia were worked more actively during the same period by the Magyars than at any other time, and by means of local peasant labour. The explanation of this use of Slovak and other personnel to form a proletariat and to a certain extent a Slav artisan element in the old kingdom of Hungary, was the shortage of Magyar agricultural labour, highly prized on the big estates.

Farther south the centuries of mastery by the Ottoman Turks had the same crippling effect on the South-Eastern Slavs. The Serbs and Bulgars [1] inherited little from Ottoman administration to stimulate them towards advanced farming and industrial technique, nor did they learn from the struggles for freedom how to exploit competently the wealth of the Balkans, which was by no means to be despised. In the Balkan Peninsula, also, another historical influence, harsh in its effect upon the Southern Slavs, became obvious in modern history. The south-eastern extremity of Europe and the Lower Danube lands formed plainly the springboard for the European Powers competing for mastery in the Mediterranean and in the Near and Middle East. Political security was a blessing unknown in this part of the Continent, and the whole atmosphere of uncertainty and violence, characteristic of the Balkan lands, tended to keep away from such an explosive region any but the shadier kind of foreign entrepreneur. Capital for initiating sound commercial and industrial activities was not available locally, and borrowed from more advanced countries farther north and west, it was always accompanied by political manipulation. In such a setting it was impossible for an artisan class to grow and flourish like that at the other extremity of Europe. The sufferings of the South Slavs in this respect were not lessened by the fact that pressure for mastery from the north-east came from the mighty Russian group. The damage done to the smaller Slav groups by the greater was hardly less than the exploitation of all these peoples by those of North-Western and Central Europe.

Within the Russian Empire itself three features of political and economic development showed the overwhelming obstacles to the increase of an artisan class. For a number of reasons personal servitude took hold in the territories of the Tsar, just when mobility of labour was beginning to contribute to the building up of the artisan group in North-Western Europe. Laws which clogged any attempt to change dwelling or occupation persisted even after the emancipation of the serfs in 1861, because the control of the *mir* or commune over peasant existence was not broken until after the Revolution of 1905. Thus whereas in Germany during the last part of the nineteenth century a competent manufacturing class was formed with terrifying speed and success, mainly from those who had been part-peasant and part-craftsman, a timid conservatism prevented such migration in Russia. The facts that the shortage of labour was often bewailed, and that the available farming land was overcrowded, owing to the persistence of crude methods of cultivation and pastoralism, were not enough to jerk the governing class to action.

In Russia, secondly, capital was lacking, even if labour had been more readily available for a greater exploitation of resource. Political unrest was all

[1] There is again the exception of the rule of the Liberal Pasha, Midhat, in Bulgaria at the time of the Russo-Turkish War of 1877. Miller writes "His residence at the provincial capital of Ruschuk conferred great material benefits upon the thrifty and laborious population. In fact the Russian officers who visited Bulgaria during the war of 1877 found that the 'little brothers' whom they had come to free were better off under the Turkish yoke than many of their own *mujiks* under the benevolent despotism of the Tsar." See "The Ottoman Empire and the Balkan Peninsula," 'The Cambridge Modern History,' vol. XI.

too obvious, and foreign investors were more inclined to interest themselves in the development of the British Empire, the United States, and even in the more stable South American republics, than in an Empire in which political upheaval was considered inevitable and perhaps imminent. Finally the huge peasant class, freed from personal servitude in 1861, was liable to heavy money payments to meet the taxes due. Such burdens drove the peasant to continue producing his own necessities in manufactured goods and, if possible, a small surplus for local marketing. He had no cash to spare for goods manufactured by artisans: on the contrary, he wanted to sell handicrafts to get ready money, and peasant purchasing power, which might have formed a valuable cheap market, was negligible as long as harsh financial exactions were maintained.

Slav scholars at the beginning of the twentieth century could logically satisfy themselves that the economic immaturity of most of the Slav groups had an ample explanation. Historical and geographical influences provided it. It was therefore perhaps allowable to believe that in time the age-long influences of environment and tradition might not prove insuperable, and that Russians, Poles, Slovaks and Ruthenes, Croats, Serbs, and Bulgars would follow slowly in the path of the Anglo-Saxon and Teutonic peoples in building up manufacturing and trading economy, reflected largely in the prosperity and responsibility of an artisan class. Thus, after the upheaval of the 1914–18 War and the disintegration of the three great Empires of Central and Eastern Europe, all the Slav peoples except the Russian clutched at the idea of developing economies somewhat along the lines of those evolved in nineteenth-century Europe.[1] Just as constitutional theory was borrowed from the west, for example, in Poland and Yugoslavia with indifferent success, so economic practice in production and trade was modelled largely on the western pattern in spite of the shock which four years of war had given to time-honoured traditions. The most remarkable innovation in most of the new states was indeed felt in the countryside, in the altered status of the peasant farmer. These instincts suggested that, given time and political independence, the Western and Southern Slavs, at any rate, were feeling after such material assets as the peoples of North-Western and Central Europe had abundantly accumulated in the course of some four hundred years.

The most important Slav group however was aware that there was no longer any point in trying to follow the examples of North-Western and Central European peoples in the creation of a national economy. It was an important landmark in political and economic thinking, even though the programmes associated with it were experimental, clumsy, and ruthless, and involved much suffering. The pattern of production and trade evolved gradually from the sixteenth to the twentieth century was to many Russians

[1] Such possibilities were also evident to the Germans and accounted for their continued loathing of the Slav peoples. The fear of genuinely Slav exploitation of Slav resources in the future is in part behind the present ruthless Nazi reduction of the structures built up after 1919, the extermination of the educated classes, the deportation of labour, the looting of plant and raw materials.

no longer satisfactory. They suspected the cycle of capitalism in Europe and the New World of being near completion before the majority of Slav peoples had been in a position to do more than suffer from the system. True, the Communist party in Russia, aware of the crying need to develop the wealth of the U.S.S.R., and of the great possibilities accruing from such an effort, could not cut loose immediately from the remains of the capitalist system surviving outside its frontiers. The need of the Russians for foreign capital, skilled labour, and foreign trading relations between the two wars showed beyond a doubt dependence on the old economic structure of world-wide extent and deep-rooted tradition. But the avowed intention in Russia was to steer clear of an economy on the accepted pattern of North-Western Europe, and to create a producing class in town and country with a different background and outlook from those ascribed either to artisan or peasant populations farther west.

The present course of world history justifies once more this question: Why study the contrast between the majority of the Slavs and the peoples of North-Western and Central Europe? Why point to the tradition of strong artisan groups on the one hand and their weakness on the other, and insist on the importance of this distinction? Is it not because there are good grounds for thinking that a great cycle of political and economic development which began in the sixteenth century is nearing its close in the twentieth? There has been an unquestioned expenditure of human energy in the last four hundred years upon the opening up and using of natural resources through the agencies of capital and individual and group enterprise. It has been the main theme of existence in a great part of the Old World and much of the New, involving a sharp emphasis on mechanical efficiency and material well-being. Such a theme has been more and more strongly implicit in all forms of Anglo-Saxon and Teutonic culture, as well as in economic enterprise, in art and architecture and drama, in literature, philosophy, and religion. But its most obvious reflection, given certain environmental conditions, has been occupational, that is to say the growth in parts of Europe and North America of an important artisan element in the population of several states.

Naturally enough there is much questioning during the present crisis of the assets and liabilities to mankind produced by the trend of human energies over four centuries of modern history. But for the purposes of this paper the rights and wrongs of the capitalist system are not immediately relevant. Human groups have worked through these phases of exploitation of environment, and whatever the associated benefits or evils, nothing now can alter the characteristics of man's effort during the period in question. What matters for the study in hand is the degree of participation by different groups in the most formidable economic system yet known to the world. The Slav groups were variously affected as we can see. The Czechs and western Poles were committed to it: all the Slav peoples suffered rather than gained from contact with it. They have been for centuries less forceful in proportion to their numbers and resources than the groups farther west because certain circumstances arrested manufacturing and trading activity amongst them at a simple stage. They were condemned to endure the aggressive policies of peoples

with greater technical competence and stronger financial organizations than their own. In their homelands they accepted lower standards of living than in the west, if standards of living be rightly measured in terms of material possessions and opportunities, because they had not learned fully the technique of making the most of their natural resources. What they managed to borrow from the west, for example in Imperial Russia, brought as much wretchedness as well-being to those directly affected. One has only to remember the slum quarters of cities like Łodz and Leningrad, and those of the Donetz mining towns, to be aware of it.

But although the Slav peoples experienced mainly the liabilities of the accepted economic system and have been horribly involved in the violence of its collapse, only a small proportion of them to the whole has been deeply compromised. If the structure which had taken root in North-Western Europe and the United States had been as firmly and prosperously established in Russia, the Soviet system, whatever one may think of its policies and methods, could not have been evolved and set in motion effectively in the short space of a generation.[1] Inhabitants of so-called maturer lands were so deeply concerned with the destructive element in the Soviet experiment between the two wars, that they forgot the extent to which the Russians were able to build on foundations grown unfamiliar to many Europeans and to those in the New World.

This comment is true, although less conspicuously, of all the Slav peoples, even the industrialized Czechs, although it has not been rightly understood. In the first place there was not time to exploit this partial immunity from the economic system of the advanced groups after the first World War before the second developed, sweeping away the tentative efforts of a single generation. In the second, German ferocity towards the Slavs, and German spoliation of Slav territories and resources for the moment fill the mind. It is difficult to envisage a resurrection from the present depths of misery and destruction. Yet in contemplating the painful recovery which must take place in the years to come, thinkers in the regions of artisan predominance in the Old World and the New can detect some curious assets for the Slav groups which are the outcome both of geographical setting and of long-standing and rather tragic historical influences. Their policies must be different from those of groups who have the tradition of large and important artisan elements, although it is unlikely that the presence or absence of such a stratum in the population will reflect as faithfully in the future as it has done in the past the political and economic standing of a state.

Two well-established features of the Slav peoples, until recently considered as signs of primitive poverty, might indeed arouse the envy of more advanced groups. One is the solid relationship of the peasant majorities to the land.

[1] Many students of Russian economic history have pointed out, for example, that a generation only separates the destruction of the traditional *mir* or commune from the establishment of the collective farm. Agrarian policies were practicable in Russia on account of the preservation of a rural hierarchy in comparative remoteness, which would have been unthinkable elsewhere. Moreover for the same reason the Soviet Government could draw on and educate a supply of labour for manufacture and trade, for whom the conception of private property was nothing like as rigid and deep-rooted as in the populations farther west.

This link the Germans have tried frantically to weaken through the deportation of male labour and through a regimenting of farming activity which amounts to organized looting, but it is so strong, so long established and so universal that it can probably withstand the pressure of military conquest and economic persecution. One would not wish, of course, anything like the restoration of the *status quo* before 1939 for most of the Slav peasants. As Lewis Mumford [1] has pointed out, the persistence of self-sufficient peasant economies along the lines described in this paper, means the perpetuation of the crudest forms of poverty. But such regions have escaped what is probably graver damage, and a problem which haunts the zones of artisan predominance in North-Western and Central Europe and the United States, the too complete abandonment of the land by one-time craftsmen and peasants. Secondly, the Slavs have retained a consciousness of regional diversities, which has logically enough weakened to the point of disappearance in the countries experiencing most deeply and for generations the standardizing effects of capital and intensively developed communications. Once obliterated, such a sense of the *petit pays*, as the French call it, is difficult to restore except on artificial lines, and yet it is the very salt of existence for man if he is to maintain any intelligent relationship with his environment. The very remoteness of the Slav peoples from the strong economic forces of North-Western Europe, may have preserved for them a setting in which new planning is more straightforward than in countries where the population is largely given over to the uniformities and mechanical processes associated with huge artisan groups. Those who reflect upon the possibilities of recovery after the present upheaval are just awakening to a right estimation of these advantages. It is perhaps comforting that they accrue to peoples who have ranked low so far in economic and political achievement and whose hardships have been very great.

ROSTHWAITE MORAINES AND OTHER LAKELAND NOTES

THOMAS HAY

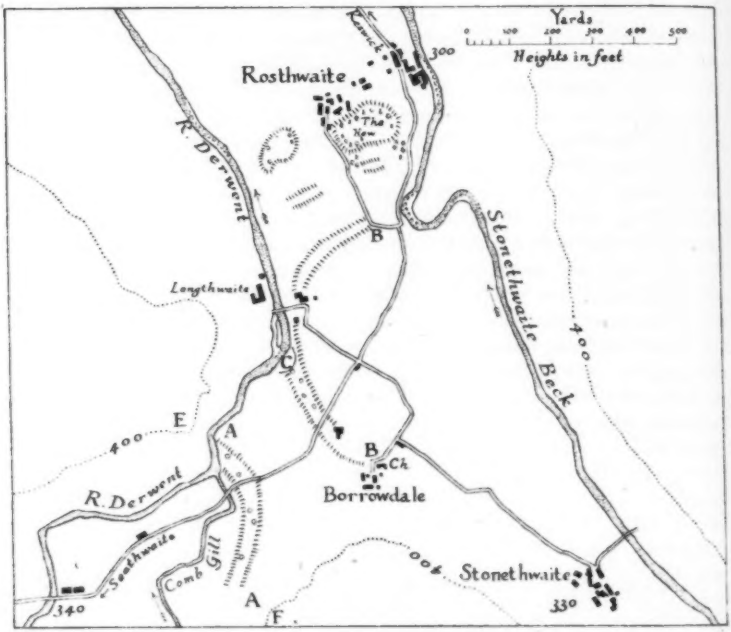
ROSTHWAITE has the distinction, rare in Lakeland, of showing two nearly complete terminal moraines. They mark the ends of the Seathwaite and Stonethwaite glaciers at a halt when these two streams of ice ceased to be confluent or alternatively at the downward limit of a readvance. These moraines have been mentioned by both Ward and Marr. The former refers to "several long narrow moraines stretching across the end of the Seathwaite valley," but he does not distinguish between them. Marr pointed out that one belt belonged to the Seathwaite valley and the other to the Stonethwaite.

The most noticeable part of the Seathwaite moraine belt is shown at AA

[1] L. Mumford, "The culture of cities,' London, Secker and Warburg, 1940.

on the sketch-map. The belt is really double, and along the crest and sides there are still biggish boulders; at one place within the belt there is a small hollow where a tarn or pool has been filled in. The northern end of the moraine is about 25 feet above the Derwent. The Seathwaite moraine has not only influenced the course of the Derwent but has also pinned down Comb Gill to its present position.

The Stonethwaite moraine, BB, covers a longer stretch but is similar to the Seathwaite. It has nearly been breached twice: once at C on the north-west, where the Derwent has cut a small semi-circular river terrace, and again



where a new house has recently been built. The erosion on the north-west has made that side steeper, and the top more of a ridge. With the result that the drop from the moraine to the field level on the south-east is 12 feet, while the drop to the river terrace on the north-west is 30–40 feet. The moraine runs through parts of Longthwaite and is continued as a smaller mound up to the main road near some new iron railings. There is a small parallel moraine-roll slightly downstream; between the moraines there is a small dried-up tarn.

Just west of the hotels at Rosthwaite there is the very noticeable How, a big remainder *moutonnée* rock knob, covered with morainic matter on the upstream side and overgrown with trees. This rock is the cause of the preservation of the two moraines described above, for it lies between the Derwent

and the Stonethwaite Beck and, since the last ice retreat has held these two becks apart. From the sketch-map it can be seen that the Seathwaite moraine abuts at E against the higher ground of the southward-facing fell. It is here that the ablation channel of the glacier would have been likely to develop, and not at the south end at F, lying on the northward-facing slope of Rosthwaite fell. That ablation stream, the Derwent, has eroded the north-west side of the Seathwaite moraine at C, but never wandered farther in that direction. The Stonethwaite Beck makes a great loop opposite the east end of the Stonethwaite moraine. On examining the beck between this point and the junction of Greenup Gill with Langstrath Beck, the most noticeable features are two well-developed river terraces. The loop may point out the place where the stream cut down the moraine and one set of terraces may belong to the previous higher level of the beck before the cut took place. The present bed shows much erosion; the level middle land inside the moraine near the church and school standing noticeably higher than the immediate valley of the beck.

The How consists of a beautiful blue tuff of medium texture with vertical jointing. It is a good illustration of the fact that in this area the remainder *moutonnée* rock is nearly always massive and with vertical jointing. It also shows a feature common to the *moutonnée* rocks in the Borrowdale valley between Grange and Rosthwaite: the rock top is not one evenly rounded mass, but is ground into a series of parallel whalebacks pointing down the valley.

This description of the Rosthwaite moraines and their preservation has been elaborated because it has a bearing on the wider question of the general lack of terminal moraines in the Lakeland valleys. The floor of these valleys is often flat where braided streams could wander and the side slopes are often steep where the comparatively loose material of a terminal moraine would disappear quickly. This may have resulted in former terminal moraines being subsequently destroyed. At Rosthwaite if there had been no How there might have been no moraines at the present time. Thus the retreat of ice in these valleys may not have been quite so rapid and continuous as it has sometimes appeared.

High level erratics

High level erratics are always interesting. They are not at all common, but they may give valuable clues as to ice movements uninfluenced by mere valley glaciers. During a visit to Rosthwaite I found two new examples. The first was a fairly large boulder of well-bedded tuff resting on a very coarse tuff on the south slope of Thunacar Knott at 2300 feet. It was not however easy to make any conclusion as to direction of movement. The second example was of two Borrowdale erratics resting on Skiddaw Slate on the ridge running from Dale Head north-west to Hindscarth and Robinson, some 50–100 feet below the summit of Dale Head and consequently about 2400 feet above sea-level. These erratics are big oblong boulders and lie straight across the ridge, being oriented south-west to north-east and west-south-west to east-north-east respectively. Except for the very head Newlands valley lying to the north of this ridge is in Skiddaw Slate. It is not at all likely that

these erratics came from there. It looks as if they must have been crossing this ridge in a north-east direction from some point near Kirk Fell. Lower down the ridge on the col between Dale Head and Hindscarth there are many Borrowdale erratics on the Skiddaw Slate, again coming from the south or south-west.

One of the most interesting places for erratics in the district is the long ridge of high ground running from Pike of Blisco round by Red Tarn to Crinkle Crags, Shelter Crags, Bow Fell, and Esk Hause. There is a large erratic well perched on the east slope of Pike of Blisco at 2030 feet, and from there to the summit at 2300 feet the whole shoulder is strewn with them. After crossing the headwaters of Browney Gill and reaching the Bow Fell range there are more erratics. On the rise to Crinkle Crags there is a great mass of rhyolite and on this there are many bedded-tuff erratics which have probably come from the north along the ridge or out of Oxendale on the right. At the very beginning of Crinkle Crags there is a good erratic on the right of the track at 2540 feet. The second Crinkle has one at 2690 feet and there are several near the top at 2800 feet. A well-perched block lies on Shelter Crags about 2670 feet near a tiny pool. Still going north passing Three Tarns and reaching Bow Fell there is a good specimen near the top at 2800 feet. The whole of this high-level ridge has a number of erratics, many of them probably quite short-distance examples. The track back from Esk Hause to Rossett Gill lies roughly about the 2000-foot contour. It passes the gloomy hollow of Angle Tarn, where there is a fine combe with a north-east facing cavity and a good moraine belt. Considering its height there is a phenomenal amount of drift along this path. Usually there is no great depth of morainic matter at such an elevation except just below individual combes. Farther south on the east side of the ridge the great hollow drained by Hell Gill, Crinkle Gill, and Browney Gill is also choked with a great deposit of moraine. In this loose deposit the three gills and their tributaries are cutting steep-sided valleys with interfluves largely of drift with flattish tops and steep sides. The whole area shows many scars caused by rushes and landslides.

Greenup Combe

The typical combe in Lakeland is a deep cup-shaped hollow backing into an elevated plateau or summit. Good examples are found in the hollows occupied by Helvellyn Red Tarn or Haweswater Blea Tarn. Many others, such as Kepple Cove, Nethermost Cove, and Burtness Combe, might be enumerated, which all conform to this general type. But there is another kind, a shallower saucer-shaped hollow, which is formed when the back wall does not reach such a height, and where there is no steep wall of cliff. Good examples are found in Greenup Combe, the hollow at the head of Greenup Gill, and in Blea Water Combe north of Ullscarf. In these the cliff backing is absent and the scenery lacks the impressiveness of the more developed type. Gillercombe, between Base Brown and Brandreth may be taken as occupying an intermediate position. It is a finely shaped combe but it lacks a steep head wall. The main cliff development occurs on the western side under Brandreth and not at the head where it backs on to Green Gable. The slopes of this

Greenup moraine belt, showing present stream bed on left and former ablation channel on right

Stonethwaite Beck

A

B

C

Rattlebeck section

combe are choked with drift, often cut by main-slope runners into rounded tongues or sharper ridges of drift.

Greenup Gill Combe is famous for its moraine mounds. The track from Borrowdale to Grasmere goes up this valley, and during part of the way it runs along what is really a terminal-lateral moraine of the Greenup glacier at a rather late stage of its existence. Marr has called attention to the asymmetry of the Helvellyn and other ridges owing to the greater glaciation on the eastern side. A somewhat similar asymmetry occurs in valleys and combes. In a valley running nearly north and south, as in the case of Greenup, the ice hugged the slope facing east long after it had left the sunnier slope facing west. Thus the disposition of some of the moraine mounds is oblique to the direction of the valley, and it sometimes looks as if there was a medial moraine, whereas it is really a lateral moraine of the diminished glacier clinging to the shady side of the Greenup valley. When the track works its way through the moraine mounds and comes out on the comparatively flat upper end of the valley at 1200 feet or thereabouts, a good view is obtained of the shallow saucer-shaped combe still choked full of the hummocky drift. There has been a considerable tarn here, of which the outlet has cut down the moraine barrier to give the beck its present position near the west side of the valley. But before that occurred the ice still covered the western side, and the ablation channel cut a wide gap through the moraine belt towards the eastern side of the valley. This opening shows up clearly in the plate facing p. 122. From the slopes of Ullscarf to the north-east and about the height of 2000 feet, a very fine view of this shallow combe can be obtained in which the sloping evening light brings out the multiplicity of the moraine mounds. The same asymmetrical deposition of the latest moraines can be seen in the Seathwaite valley morainic matter left by a dwindling glacier hugging the shady west side of the valley and sometimes placing this deposit almost like a medial moraine.

Other examples of this low-level saucer-shaped combe occur in the area around Great Langdale. Such a hollow lies between Pike o' Stickle and Harrison Stickle, but in this case the saucer is not filled with moraine mounds, and contains many biggish masses of *moutonnée* rock. It may be mentioned here that there is a striking view from Pike o' Stickle down into Mickleden, and if the light is good it shows up the moraine mounds at the foot of Rossett Gill.

From Blea Tarn, lying in a cross valley between Great and Little Langdale, there is one of the best-known views of the Pikes. The tarn lies at the southern end of a low-level saucer hollow which is still filled with moraine mounds of a somewhat subdued contour. This hollow is a very low-lying example, as it is only about 600 feet above the sea.

Another illustration occurs to the north of Stickle Tarn occupying a very boggy hollow at the foot of the Pavey Ark high ground. This lies at an elevation of 1600 feet, and is filled with the typical mounds of drift. This example, along with Pavey Ark itself, provides a complex case. Pavey Ark and Stickle Tarn form a good illustration of the deep orthodox combe, while the tarn area is prolonged to the north into a saucer-shaped hollow filled with the usual collection of moraine mounds.

These saucer hollows are undoubtedly due at least in part to the action of

ice, and they may be looked upon as a connecting link between the orthodox combe or corrie and the shallow nivation depressions described by Matthes and other writers. They seem to be more frequent to the west of the Dunmail Raise through-valley.

Rattlebeck section

This section, on the left bank of the Glenridding Beck just below Rattlebeck bridge, is a striking example of boulder clay above a deltaic deposit. Since its mention in the *Journal* for August 1934 (p. 143), and again in the *Journal* for November 1937 (p. 445), a great slice of the left bank has been washed away, and a few more years may see the disappearance of its interesting succession of layers. At first I thought the delta was an example of the Swiss "moraine en delta," but the absence of boulders makes it seem more likely that it is an ordinary upland delta deposit. The different deltaic layers have many sizes of pebbles and it is therefore possible that even if not right at the ice front it was not far from it.

There are four distinct layers : (1) Just above the water, a stony boulder clay almost horizontal but dipping slightly downstream (Plate C). (2) The delta, dipping downstream at an angle of about 18° (Plates A and B). (3) The lower part of the upper boulder clay. The photograph was taken during a dry spell and the darker layers are merely moister (Plate A). (4) The top part of the upper boulder clay separated from 3 by a roughly horizontal line (Plate A).

The uppermost layer, No. 4, is about 6 feet thick, and is therefore not merely the weathered top of the boulder clay, which is about 18 inches thick and reddish in this neighbourhood. Layers 3 and 4 are interpreted as the combined deposit from an ice sheet which advanced over the delta deposit and has left the lower part 3 as its ground moraine, and the upper part 4 as its englacial deposit.

It is unlikely that the delta in the Rattlebeck section is pre-glacial, and whether the top boulder-clay is the result of a separate glaciation or merely of a readvance, the section is a good example of a boulder clay lying on the top of a deltaic formation. Marr, in his 'Geology of the Lake District,' records a section near Elterwater Bridge in which there was a red boulder clay at the base and a grey at the top. At the right-hand side of the section the two came together with a sharp line between. At the other end they were separated by some roughly stratified gravel. In summing up his section on "Oscillations of the ice" Marr says that the evidence so far is not antagonistic to the intervention of an interglacial period.

THE FLOOR OF THE OCEAN

THE FLOOR OF THE OCEAN; new light on old mysteries. By R. A. DALY. (Page-Barbour lectures at the University of Virginia, 1941.) *Chapel Hill: University of North Carolina Press*, 1942 (*Oxford University Press*). 9×6 *inches;* x+178 *pages; illustrations, diagrams, and sketch-maps.* 15*s*

UNDER this title Daly has published in book form the contents of three lectures given at the University of Virginia. It includes three chapters entitled: The foundations of the Great Deep; Submarine mountains; and Continental terraces and submarine valleys. The results of several recent geophysical investigations and the light they throw upon the foundations and relief of the oceanic areas are presented in a readable form as free as possible from technical terms.

The relief of the ocean floor has been studied mainly by sonic soundings, but only a small fraction has been as yet examined in detail, though it is probable that sufficient has been done to indicate the main trend of future discoveries. The deposits on the floor of the North Atlantic have been probed to a depth of 10–14 feet by the use of the Piggott gun, which fires a tube into the bottom deposits and draws a core. The investigation of these samples has not yet been completed; they are expected to yield a record of sedimentation in that area for many thousands of years.

Of more fundamental significance in their relation to the constitution of the ocean floors in comparison with continental areas are the recent studies of the velocities of earthquake waves through the crust, and the determinations of gravity in the oceanic areas. These last have been obtained chiefly by Dr. Vening Meinesz by swinging pendulums in a submarine, usually submerged to such a depth as greatly to reduce the effects of disturbances at the sea surface.

It has been known for some time that three distinct types of waves are produced by an earthquake shock: the compressional or push waves, and the distortional or shake waves, both penetrating to a considerable depth below the surface of the earth; and the so-called surface waves which tend to die away somewhat rapidly in depth. The velocities of these waves depend upon the elastic properties and the density of the material through which they travel.

The records of near earthquakes indicate two, and sometimes three, distinct pairs of push and shake waves, and it has been inferred that there are at least two and probably three distinct layers in the so-called crust of the earth; from the velocities of each pair, assuming that the density of the material traversed is the same for both, the elastic properties of each layer can be inferred. Since, apart from a relatively thin superficial layer of sedimentary rocks which is usually ignored, the rocks which appear at the surface have a composition approximating to granite, the upper layer is usually termed the granitic layer. The compressibility of that layer is however substantially less than that of granite as determined in the laboratory, even at considerable pressures, and the difference is attributed by some to the effect of temperature. The properties of the lower layer seem to agree most nearly with those of a basic rock peridotite consisting mostly of olivine, and no allowance for temperature seems to be required. The possible nature of the intermediate layer has given rise to differences of opinion: some regard it as tachylite, a glassy form of basalt; others suggest it may be a crystalline rock such as diorite or gabbro.

Comparison of waves which have traversed mainly oceanic areas with those whose paths lie across the continents suggests that the granitic layer is thin or absent under the oceans. This appears to be confirmed also by the fact that the

surface waves travel on the whole faster over oceanic than over continental tracts, and the best hope of arriving at a conclusion regarding the constitution of the ocean floors seems to rest on further studies of these waves, which however require the establishment of new, suitably placed, seismograph stations on some of the Pacific islands.

Daly's picture of the crust does not however agree with seismological results, since in the oceanic areas he favours three layers in order, gabbroic sima, vitreous basaltic sima, and vitreous peridotitic sima, while in the continental areas he has five layers (apart from a sedimentary skin): granitic and intermediate as well as the three layers present under the oceans. Some maintain that there is no seismological evidence of a gabbroic layer which in Daly's picture is the one universally present.

The new gravity determinations in the oceans have reinforced the conclusions previously drawn for the continents that the rocky material which projects above, let us say, sea-level does not exert the gravitational attraction which might be expected from its mass, but is approximately balanced by downward projections of the relatively light crust into the denser layers below. This is the principle of compensation. For the oceanic areas the conclusion is drawn that the crustal material below their floors is denser than that which underlies the continents, but that they are approximately in isostatic equilibrium, or compensated.

Daly concludes from the geophysical evidence, mainly the widespread existence of isostatic balance in the oceans and continents, that it is "necessary to postulate a thick layer of exceedingly weak rock, that begins at a depth of 50 miles" below the surface. This weak rock is the vitreous layer shown in his diagrams. One great objection to a universal weak layer at such a relatively shallow depth is the occurrence of deep-focus earthquakes, four or five times deeper than the top of the weak layer. Such earthquakes are for various reasons believed to be due to shearing fractures and the stresses which ultimately produce the rupture must have accumulated for a long time prior to the shock. The material down to the depth at which these shocks occur must therefore have some strength, and does not continuously yield to the stress differences generated there.

Yet the behaviour of the Fenno-Scandian region under the Pleistocene ice-load, and the rise of that area subsequent to the melting of the ice, is considered to justify this assumption of a weak layer within a limited depth below the surface. The evidence for this conclusion may be briefly summarized. When the ice withdrew from the region, the sea covered a vast area around the perimeter and the enlarged Baltic spread widely beyond the present margins of the gulfs of Bothnia and Finland. Subsequently these areas have risen and are still rising, so that marine deposits and old shore lines now stand in places several hundred feet above sea-level. The area affected by the elevation is roughly elliptical, extending from central Denmark to beyond the North Cape, and from outside the Lofotens to near Lake Ilmen, somewhat over 2,000,000 square kilometres. The maximum elevation is over 275 metres on the west side of the Gulf of Bothnia; tide-gauge readings and other observations show that the same general area is still rising at a rate which increases from zero near the margin to 10 millimetres per annum in the Gulf of Bothnia. From the rate of rise during the past seven to eight thousand years it is estimated that the central region may rise a further 210 metres or a total of nearly 500 metres.

Gravity observations indicate that there is a negative free-air anomaly over at least the eastern half of the area, which is interpreted as an indication of further rise before equilibrium is established. The gravity results are however

averaged over wide belts, and this conceals to some extent considerable irregularities, so that the correspondence between the negative anomalies and the rising area is not as close as these averages lead one to expect.

Daly maintains that the area under the ice-cap of North America shows the same phenomena, and that the central area in Hudson Bay is rising faster than Scandinavia. This statement is directly contrary to W. A. Johnston's observations near Fort Churchill, which appear to show no appreciable rise within the past two hundred years.

Granting the conclusions regarding ice-loading and isostatic recovery in the Fenno-Scandian region, it is interesting to consider one of the consequences on the area surrounding the zero isobase. The average elevation that has already taken place is about 180 metres, and when the "weak rock" was forced out a volume of about 400,000 cubic kilometres was displaced. This presumably caused the area around the periphery to rise, and if it be assumed that a width of 500 kilometres was thus affected, the average elevation within the peripheral bulge would be about 110 metres and the maximum rise about 180 metres. Under this assumption the area affected would extend from Denmark to the Zuider Zee and from Lake Ilmen to Moscow; it just misses the British Isles. In consequence of the rise subaerial erosion should have developed narrow ravines of a great depth coinciding mainly with the existing river courses, and such ravines should be discoverable by geophysical explorations. Further positive free-air anomalies should occur; it is of interest therefore that Nörgaard, using a gravity meter, has reported a considerable positive anomaly in Jutland which lies near the centre of the bulge area postulated above.

Nothing in these results gives a clue to the depth at which the weak layer is supposed to occur. Daly sees however in the vast masses of basaltic material poured out on the ocean floors and the continents a proof of the existence of a layer of vitreous basalt, but he removes the problem beyond the reach of existing tests by the statement that "until a comparatively recent geological epoch the basaltic layer seems to have been continuous all around the globe," but that "it appears probable that glassy basalt cannot now be world-wide and continuous." The change he attributes to parts of the layer having crystallized because of slow cooling of the earth. One would not have expected that the amount of cooling since a recent geological epoch would have been sufficient to produce such a radical change in the earth's crustal layers.

When he deals with the conditions of support of volcanic islands, such as Hawaii, the inference of a weak layer is not very convincing. He shows that gravity determinations in the island of Hawaii and the neighbouring Oahu reveal very large free-air anomalies, and after allowing for local compensation Hawaii still has an average positive anomaly of 142 milligals. He correctly deduces that these volcanic piles must severely tax the strength of the crust. Investigations not referred to by Daly indicate that Oahu, which is older than Hawaii, is partly compensated, whereas Hawaii is wholly uncompensated and represents an extra load on the crust. If Hawaii follows Oahu some sinking must be expected in the future, but according to Daly there is no evidence that the crust is giving way under the loads of these volcanic islands.

In this conclusion he is relying on the relation of coral islands and atolls to their foundations (usually volcanic) in accordance with his well-known glacial control theory. His plans and cross sections of atolls in the Pacific and Indian oceans all show an almost level floor within the lagoons, except where small coral masses grow to the surface. It is suggested that the base of the lagoon deposits is equally level, the underlying platform having been worn down to the level of the sea by the withdrawal of the ocean waters during the Pleistocene

period. The present assumed uniform depth of coral growth records the amount of depression of the coral foundation that resulted from the return of the water from the melting ice-sheets to the sea. In only one cross section, Suva Diva atoll in the Indian Ocean, are the lagoon deposits boldly shown resting on a level floor of volcanic rocks. The evidence for this is not stated. There is obviously a great opportunity to investigate by seismic methods the actual depth of deposits in lagoons and the nature of their floors. It may turn out that the even bottoms of the lagoons bear no relation to the base of the lagoonal deposits.

The last chapter deals mainly with the features of the continental slope which, as has recently been proved, is traversed in certain areas by many deep submarine canyons; while the intercanyon areas are closely furrowed below a depth of some 200–300 fathoms.

Daly rightly discards all theories that regard these features as of subaerial origin, eroded at a time when the sea stood several thousand feet lower than at present, and he is also critical of Johnson's hypothesis of canyon formation by the sapping action of submarine springs. He naturally prefers his own, that they were all eroded by currents of sea-water rendered abnormally dense by loads of sand and mud washed off the continental shelves. Such action would be most likely during the Pleistocene, when according to the glacial control theory the shelves were laid bare over wide areas. He is confirmed in his earlier opinion of the efficacy of such bottom currents in eroding channels by certain experiments carried out by Kuenen. He also continues to rely on the sublacustrine ravine in the Lake of Geneva as evidence of erosion, in spite of the vigorous criticism of this view recently published by Johnson.

Kuenen has attempted to apply the approximate engineering formula of Chezy to the results obtained in some American reservoirs. In some of these, muddy waters carried down during heavy floods have been shown to travel on the bottom of the reservoir below the clear water even to the outlet, and the velocity and thickness of the muddy current have been determined at several points. From these Kuenen has attempted to derive the so-called constant in the Chezy formula. This constant is applied by Daly to the hypothetical muddy currents which formerly flowed down the continental slope, although the slope is about one hundred times as great as in the reservoirs. Farther, the application of the data given in the notes on p. 116 leads to a value of the constant substantially different from that obtained by Kuenen and adopted by Daly. The study of density currents whether due to an excess load of sediments or to other causes has not progressed far enough to enable them to be used with any confidence as an explanation of the features of the continental slopes.

These are some thoughts provoked by a book which is well worth reading and consideration. O. T. JONES.

REVIEWS

CENTRAL AND SOUTH AMERICA

NETHERLANDS AMERICA. By PHILIP HANSON HISS. *New York: Duell, Sloan, and Pearce,* 1943. 9 × 6½ *inches;* xiv + 226 *pages; illustrations and maps.* $3.50

The Netherlands territories in the West Indies and South America, though relatively small, having an area of 55,500 square miles and a population of 300,000, present much variety in their social and economic life, and have at

present an importance much greater than those figures convey. In addition their history exhibits the turbulence and changing fortune characteristic of the West Indies in general. All this has provided Mr. Hiss with material for a lively and informed book, with wider implications than the title suggests. He brings out effectively the contrasts between the cosmopolitan settlements around the oil refineries of Curaçao and Aruba, the isolated and struggling white community on Saba, and the bush negroes and bauxite workers of Surinam.

In these territories white settlers have failed or are threatened by absorption, yet as a result of historical and economic development European and American interests are firmly established. The events of the immediate past have strengthened these, for Surinam supplies 60 per cent. of the bauxite used in the United States and the oil refineries produce nearly half a million barrels a day. The author describes clearly the results of this impact upon peoples with a relatively low standard of living, and the problem of reconciling the interests of communities drawn from many parts of the world: one-sixth of the population, for example, is British Indian settlers in Surinam. With regard to the future, he sees that autonomy would be impracticable and that the links with the outside world cannot be severed; progress can only be achieved by an appreciation of the issues involved by all parties, and a gradual improvement of the technique of colonial administration.

The book is illustrated with many good photographs which emphasize particularly the variety of human types. There is also an appendix of comprehensive statistical tables. G. R. C.

ECONOMIC AND HISTORICAL GEOGRAPHY

COMMODITY CONTROL: a study of primary products. By P. LAMARTINE YATES. *London: Jonathan Cape*, 1943. 9×6 *inches;* 248 *pages; diagrams.* 15*s*

Mr. Yates' aim is to draw out the consequences for economic policy of the inadequacy of price movements, unsupported by other controls, for balancing demand and supply in the case of primary commodities. The inelasticity of supply of primary commodities is due to a variety of causes. Whatever the cause, there is no question of the fact; price movements affect the supply of many primary commodities only slowly, over a period of years, and, in the case of downward movements, at the cost of severe sufferings on the part of producers, and disturbance to the world economy.

It is argued that in the case of commodities for which an expanding market can be expected, such as oil or rubber, the right policy is to prevent short-term fluctuations by means of buffer stocks, and to adjust supply to demand in the long run by gradual alterations in the price at which the buffer stock authorities are prepared to buy. There are other commodities, such as wheat, coffee, coal, and cotton, for which demand even in a world of full employment and general expansion is unlikely to increase greatly, and in some cases may fall. One of Mr. Yates' most interesting points is his demonstration that the apparent overproduction of a commodity such as wheat before the war was not merely a fiction based on the selfishness of producers and the disorganization of the world economy. For cases of this kind Mr. Yates proposes quotas as well as buffer stocks, since buffer stocks alone, while perfectly adequate for regulating additions to productive capacity, provide no means of reducing output below an existing level except the slow and uneasy method of price pressure. The quotas would be administered by Commodity Councils on which the Governments of both producing and consuming countries would be represented. Mr.

Yates suggests that quotas might be modified periodically by a kind of auction; the country whose producers bid lowest might be awarded a given percentage increase in its quota. It is recognized that no single set of principles can be applied to all commodities, and that special measures will be needed in several cases; conservation measures for oil, for example, or temporary quotas to deal with the war-time increase in the production of copper.

'Commodity control' is very well balanced and valuable study both of the nature of the problem and of its possible solutions, and it should not be taken as a criticism of what has been written if at least one reader feels inclined to ask for more. More might have been said about conservation; it is not easy to find actual facts about, for example, the probable future effect on the world output of various farm products of measures to check soil erosion. There is scarcely any mention of the inadequacy of international statistics of many forms of primary production, and still more of the recovery of metals from scrap; this is a question to which the British Association's Conference on Mineral Resources and the Atlantic Charter rightly devoted a great deal of attention. One would have liked more detailed reference to the way in which some of the problems of commodity control affect this country; how far, for example, can we continue to buy controlled commodities through private concerns acting under official supervision, and how far will direct State buying become necessary in peace-time as a result of international controls? Again, the suggestion of a General Commodity Council is carried into just enough detail to be tantalizing; one would have wished to see this proposal related to the general problem of international economic planning, and to have some discussion of the possibility of bringing in non-Governmental representatives, apart from the trade interests directly concerned, possibly on the lines of the I.L.O. These are not so much criticisms of Mr. Yates' work as illustrations of the vast amount of ground which he was unable to cover in the space at his disposal, and which will have to be covered before a satisfactory commodity policy can finally emerge. M. P. F.

MARCO POLO'S PRECURSORS. By L. Olschki. *Baltimore: Johns Hopkins Press*, 1943. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* x + 100 *pages; map.* 9*s* 6*d*

Mr. Olschki has written a brief but valuable preliminary to the study of Marco Polo. It sets out first the ideas of Asia held by contemporaries, and the sources from which they were derived. These were mainly literary legends, based very largely upon the romances which had accumulated around the exploits of Alexander, and on Biblical texts. Though divorced from reality, they dominated the minds of Polo's contemporaries, and influenced to some extent the composition of his narrative. The author then sketches the political and religious background of thirteenth-century Central Asia, emphasizing the elements which baffled and disappointed the European missionaries "ad Tartaros," John of Pian del Carpine and William of Rubruk, whose narratives are critically discussed. Finally he considers the scanty information which has survived on the journeys of the elder Polos, to which he thinks too little critical attention has been given. As had their predecessors, the Polos returned to Europe in the belief that, in asking for the despatch of a large mission to his realm, Kublai Khan was contemplating conversion to Christianity, whereas he was more probably hoping for the assistance of scientists, technicians, and administrators. The author emphasizes that the sojourn of the Polos at Bokhara had later an important effect upon Marco's outlook, since he was brought up to regard Asia "from a Tartar angle and with a Persian touch," which prevented him from fully understanding the peoples of China and India. G. R. C.

THE MONTHLY RECORD

PRESENTATION OF THE MEDALS AWARDED BY THE American Geographical Society to two British Geographers

The Officers of the Royal Geographical Society and their Ladies, and a number of friends of the two recipients, had been invited to the ceremony at the American Embassy in London, at noon on 31 March 1944, when the American Ambassador, Mr. John G. Winant, delivered the following Address:

It is with pleasure that I welcome you here to assist me in doing honour to two of Great Britain's most distinguished geographers. The American Geographical Society has charged me with the agreeable duty of presenting distinguished awards on its behalf to Sir Halford Mackinder and to Mr. Arthur Hinks, both of whom have laboured long and well in the cause of that science which serves man unselfishly in quest of greater knowledge of the earth and all its peoples. Both of these high awards have been made to men of many countries, and I count myself particularly fortunate in having the privilege this year to bestow them upon these two representatives of the British nation. I am glad to have with us on this occasion some of the officers of the Royal Geographical Society which is likewise being honoured by the bestowal of these awards to two scientists who have been intimately associated with its work. I am also conscious of the pleasure that these awards will give the many warm friends whom Sir Halford and Mr. Hinks have in my country.

Sir Halford, I am asked to present to you the Charles P. Daly Medal which in the words of the citation is "awarded from time to time by the Society for valuable or distinguished geographical services or labors." The simplicity of these words gives grandeur to your achievement. A friend has called you a great geographer in the fullest sense; a geographer by conviction. You have enriched knowledge with originality and imagination and science is under heavy debt to you both as a pioneer and as an inspiring teacher. As an explorer who made the first ascent of Mount Kenya in 1899, you have shared that close contact with the earth which is the hallmark of the true geographer. The poetry of your subject which as teacher you have so successfully communicated to others was set forth in your address before the British Geographical Association when you described geography as "an art of expression parallel to and complementary to the literary arts." You said: "It culls its data in parts from the geographical aspects of a number of sciences just as Plato and Aristotle drew upon the physics and biology of their day. It integrates its conclusions from the human standpoint and so departs from the objectivity of science, for it ranges values alongside of measured facts. Hence 'outlook' is its characteristic." It was outlook which makes your name world famous to-day as the first who fully enlisted geography as an aid to statecraft and strategy. You previsioned the true basis of what to-day has won fashion as geo-politics. Unlike less worthy successors you have always been mindful of the responsibilities owed by science to democracy and you have furthered democracy's cause in your writings and in service to your country. You were the first to provide us with a global concept of the world and its affairs and we hope it will be given us to establish the global peace for which your tireless mind has only recently set forth the pattern and inspiration.

I am proud to place in your hands this medal in recognition of the reverence in which your name and services are held both in your country and in mine.

On receiving the Charles P. Daly Medal, Sir Halford Mackinder said:

Your Excellency, Ladies and Gentlemen: In thanking you, Sir, for what you have so graciously said to me on behalf of the American Geographical Society of New York, I would like with your permission to make a few observations on two of your points.

I am grateful to you, in the first place, for the testimony you have borne to my loyalty to democracy, since absurd as it may seem I have been criticized in certain quarters as having helped to lay the foundation of Nazi militarism. It has, I am told, been rumoured that I inspired Haushofer, who inspired Hess, who in turn suggested to Hitler while he was dictating 'Mein Kampf' certain geo-political ideas which are said to have originated with me. Those are three links in a chain, but of the second and third I know nothing. This however I do know from the evidence of his own pen that whatever Haushofer adapted from me he took from an address I gave before the Royal Geographical Society just forty years ago, long before there was any question of a Nazi Party. The whole story, of which I have not the smallest reason to be ashamed, has been told, with Haushofer's statements translated into English, in a book entitled 'Generals and Geographers,' recently published on both sides of the Atlantic by the Oxford University Press, and to that source I would refer any of those here present who may be interested in tracing the origin of rumours in war time. I ought to add that the book in question was written by Dr. Hans Weigert, a German of distinguished and cultivated mind, who for the sake of his wife and child fled with them from his Fatherland to your country, Sir, in the spring of 1939, because his freedom was threatened by the Nazis on account of his adhesion to the persecuted Pastor Niemöller.

Turning from that, Sir, may I say a few words prompted by your mention of global thinking? In that Address to which I have just referred—it was entitled "The geographical pivot of history"—I argued that we were already sufficiently near to a complete knowledge of the main physical features of the surface of our Planet to justify a correlation of the wider generalizations of history with equivalent generalizations of geography. In suggesting that such an integration might have its uses as a background in framing foreign policies I had no idea of playing the part of a prophet. My objective was to place on record a statement of values, adjusted to measured facts as known at that date, in the hope that other "outlookers" would, with due readjustments, register the changes of values at successive later dates, and so vindicate the study of philosophical geography. Little did I dream that I myself would live to see my thesis so tragically tested in two world wars!

In the early eighties of last century there occurred a volcanic eruption in the Dutch East-Indies of such violence that it completely destroyed the mountainous island of Krakatoa, in the Strait of Sunda. A great cloud of the finest dust went up which, spreading in the higher and outer atmosphere, made the circuit of the Earth several times before it settled and was dissipated. I was then an undergraduate at Oxford and well remember walking out to Shotover Hill to enjoy the unimpeded view of the after-glow which for a fortnight re-lit the sky with glory when the nights were already dark an hour after sunset. In an earlier age such a celestial event would have been held a portent of the approach of some dire happening in human destiny. As I look back over the span of sixty years I cannot help seeing in that convulsion of Nature a parallel to the greatest of all human revolutions, that through which we of this generation are living.

Is not the cause of our two world wars fundamentally geographical? Has not humanity come with a shock up against the fact that after five centuries of slow

advance scientific invention has with a tremendous spurt overtaken geographical discovery? Henceforth nothing significant can happen in human affairs at any spot on this earth but what its effects will spread, like the Krakatoan dust, over the whole global surface. We have now to adapt our minds to living in a closed environment.

There is a form of madness known as claustrophobia, whose unfortunate victims cannot endure to be confined even within the four walls of a room. It is said that Alexander the Great shed tears because there were no more worlds for him to conquer. But his world was limited only by the geographical ignorance of the ancients. The Germans and Japanese of to-day are suffering from *global* claustrophobia. You do not argue with a raving maniac, you restrain him. May our idealists, when it comes to making peace, not refuse to reckon with the realities of power.

Thank you, Sir, and thank the American Geographical Society, for a very great honour.

To Mr. Hinks the Ambassador said:

I have been asked to present to you the Cullum Medal of the American Geographical Society, which is awarded to those "who distinguish themselves by geographical discoveries, or in the advancement of geographical science." Under your name it bears the inscription: "Like Ptolemy, learned in the mathematics of the celestial and terrestrial spheres." The achievements you have performed to merit this fine designation have been as varied as they are distinguished, and great must be the solace of one who has partaken so widely of cosmic wisdom. You were first an astronomer and held the honourable office of Secretary of the Royal Astronomical Society. Turning your interests to geography, you made yourself master of its mathematical intricacies. You have done more probably than any other Englishman or American to develop and clarify the highly technical subject of map projections and to introduce an understanding of its importance among geographers. You have brought credit to British science in setting the high technical and scientific standards that have been maintained by the Royal Geographical Society in its publications. We are conscious of the tribute being paid to the responsible duties you have performed as Secretary of that Society. Your works are many and learned and your honours great. Explorers such as Peary, Nansen, Scott, and Shackleton are among those who have received this medal before you. You have the satisfaction of knowing that exploration is among the many branches of geographical science which has profited from your fruitful labours.

Mr. Hinks, I take the greatest pleasure in giving you this medal signifying the very high esteem in which you are held by the scientists of both our countries.

On receiving the Cullum Geographical Medal, Mr. Hinks said:

Your Excellency: It is hard to find words to express my pride in the high award made me by the American Geographical Society, and my thanks to you for inviting me to receive the Cullum Geographical Medal from your hands.

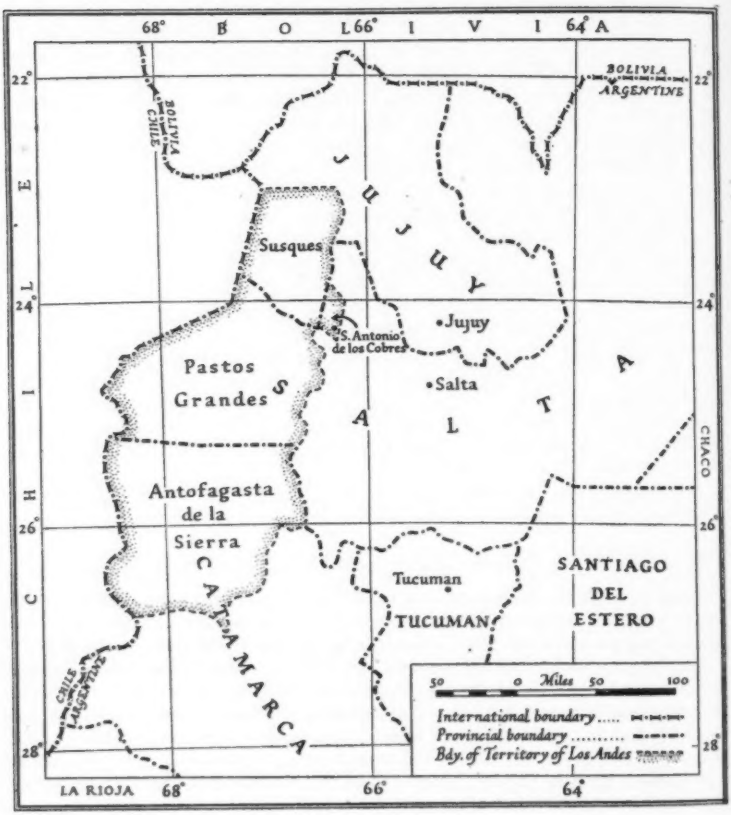
The letter which gave me news of the Award, and said kind things about myself, asked that it should be regarded also as a mark of esteem of the American Geographical Society for the Royal Geographical Society; whose President and Council, greatly appreciating the high compliments paid to our Society and its Secretary, and to its Past Vice-President, directed that this letter be printed in our *Journal*. By now nearly all Fellows will have received this friendly message.

It is a high compliment to an astronomer and geographer to be mentioned in

the same breath with Ptolemy, and I thank the donors of the Medal for their courageous opinion. When I thought to retire from office in 1939 I planned to make an apparatus of map projections and tables, and to ask leave to spend a winter at Pasadena in the library of the Mount Wilson Observatory, adjusting celestial photographs on to a new galactic projection of the sphere. "With a little foundation of learning withal, and leisure and opportunity to work upon it, how deliciously may an old man enjoy himself." The leisure never came, so I do not know how far Cicero was right. But remaining at work has brought me a great distinction, and I beg that Your Excellency will accept and convey to the American Geographical Society my profound gratitude.

CHANGES IN THE PROVINCIAL BOUNDARIES OF THE ARGENTINE

We have been informed by the Foreign Office of certain changes in the provincial boundaries of the northern Argentine. A decree published on 24 September 1943 stated that the territory of Los Andes had been abolished and had been incorporated into the adjacent provinces of Jujuy, Salta, and Catamarca.



Los Andes was formerly divided into four departments: Susques, Pastos Grandes, Antofagasta de la Sierra, and San Antonio de los Cobres. Susques, 9554 square kilometres, has been incorporated into Jujuy; S. Antonio de los Cobres, 1207 square kilometres, and Pastos Grandes, 23,994 square kilometres, into Salta; and Antofagasta de la Sierra, 27,887 square kilometres, into Catamarca.

The territory of Los Andes, part of the Puna de Atácama, was formerly claimed by Chile, but was awarded by arbitration of the United States to the Argentine in 1899 and was included in the Argentine in 1900. The territory has been described as "consisting of tortuous mountain chains, large sandy plains, and saline marshes and lagoons. There are numerous rivers, but mostly small and saline. Little agriculture or raising of cattle beyond the needs of the scattered population are carried on, the dryness, extreme cold, and high winds being against cultivation of all kinds. The territory is apparently very rich in minerals."

J A. Ricossa, writing in the *Revista Geográfica Americana*, (20 (1943) 249), points out that the territory could not be expected to take its place as a self-supporting province for a very considerable time, if at all. With 62,950 square kilometres and only six thousand inhabitants, there are few prospects of opening up the region without help from the neighbouring provinces. Communications are very poor. There are plans for extending the railway from S. Antonio de los Cobres, the former capital, across the territory, but it will be some time before these are carried out, and although there are some serviceable roads, pack mules are still the main method of transport. The people are mainly Indians, very poor and leading a pastoral life. When the territory was incorporated in the Argentine the Indians petitioned that they should be left alone and allowed to maintain their ancient rights of pasture and occupation. Property boundaries are vague and to the Indian private ownership in land does not exist. The region is so unlike the rest of the Argentine, and so remote, that J. A. Ricossa remarks that it was regarded in the Argentine as "una curiosidad geográfia."

Apart from the greater prospects of opening up the territory when included in the richer provinces of Jujuy, Salta, and Catamarca, the division also ends certain political difficulties. There had been conflicts between Jujuy and Los Andes, and the province of Salta had had claims on part of the territory since the end of the last century.

CORRESPONDENCE

NAMES OF PEOPLES IN THE U.S.S.R.

Would you please refer to Professor Minns' list on p. 140 of the *Geographical Journal* for March 1943.

I have been unable to obtain any confirmation locally—and I have inquired of my Soviet colleagues—of our neighbours to the west and north having had their name changed from Kirghiz to Kazakh. The Kirghiz A.S.S.R. still exists. And the Russians still seem to regard the Kirghiz and Kazakh as different peoples though of course they are closely related.

I can confirm that the name Kazak (more properly, I think, Qazaq قازاق) has been changed to Kazakh. This is not so much to prevent confusion with

the Cossacks, as Professor Minns' list rather implies, as because the Russians think the new name is closer to the way the people themselves pronounce their name. I have only met a couple of the encampments of this people in this province, on the slopes of Bogdo Ola in the Fukang district, but they seemed to call themselves قاراق rather than قاراخ.

To find Turks with names such as Oyrot and Khakas is queer: the names seem so much more Mongolian in form. Oyrot, in particular, suggests a connection with the Dzungar Confederacy that played an important role in these parts in the seventeenth and first half of the eighteenth century.

M. C. GILLETT.

H.M. Consulate-General,
Kashgar.
4 *September* 1943.

MEETINGS: SESSION 1943–44

Thirteenth Meeting, 7 February 1944. The President in the Chair

Elections: His Excellency Baron de Cartier de Marchienne, Belgian Ambassador, G.C.V.O., G.B.E.; Mrs. H. L. Cottingham; Mr. Robert Gibbings, M.A.; Mr. Hubert Sterland Haslam; Miss Thirza Elizabeth Jones, B.A.; Squadron-Leader Charles Thorley Kimber, R.A.F.; Mrs. John Lapraik; Mr. William Erskine Linton; Major Alexander James MacIntyre; Miss Doris Mosley, B.A.; Mr. Alexander C. Niven; Mr. J. J. Richard; Mr. Hugh James Roberts, B.A.; Mr. Maks Seidman, B.SC. (ECON.); Mr. Thomas Urquhart Taylor, B.SC.; Mr. Danford Henry Underwood; Miss M. Watson, B.A.; Mr. Newman Watts; Mr. Harold John Woodall

Paper: The Excluded Areas of Assam. By Sir Robert Reid, K.C.S.I., K.C.I.E.

Fourteenth Meeting, 14 February 1944. The President in the Chair

Paper: Surveys for power in the Coast Range of British Columbia. By Major R. C. Farrow, R.C.A.

Fifteenth Meeting, 21 February 1944. The President in the Chair

Geographical Films: Greenland, Mexico, and Yucatan With commentary by Lady Broughton